

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-243938

(43)Date of publication of application : 28.08.2002

(51)Int.Cl.

G02B 5/30  
 C08L101/00  
 G02B 5/02  
 G02B 5/08  
 G02F 1/1335  
 G02F 1/13357

(21)Application number : 2001-035665

(71)Applicant : NITTO DENKO CORP

(22)Date of filing : 13.02.2001

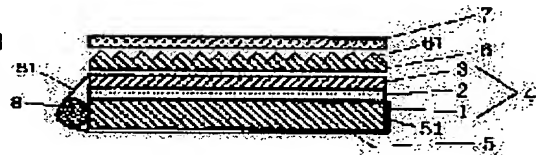
(72)Inventor : MIYATAKE MINORU

## (54) OPTICAL ELEMENT, POLARIZED SURFACE LIGHT SOURCE AND LIQUID CRYSTAL DISPLAY DEVICE

## (57)Abstract:

PROBLEM TO BE SOLVED: To develop an optical element providing an outgoing light composed of linearly polarized light the polarization direction (the plane of vibration) of which can be arbitrarily controlled.

SOLUTION: The optical element has a specular reflection layer (5) provided on one face of a laminated (4) constructed by arranging a polarized light scattering plate (3), containing dispersed birefringent micro regions and exhibiting scattering anisotropy corresponding to polarization directions, on one or both faces of a translucent resin plate (1) which is made to include a light emitting material. The liquid crystal display device is provided with an illuminator constructed by using a surface polarized light source having a light source (8) on at least one side face of the optical element and the optical element. Consequently, the liquid crystal display element excellent in brightness is formed which required no special light emitting means such as reflection dots formed on the translucent resin plate and makes light incident from the side face and the surface of the element and emits, from one of the front surface and the rear surface of the element, linearly polarized light with vibration direction arbitrarily controlled via an optical axis of the polarized light scattering plate due to exciting light emission.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

\* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]

[Claim 1] An optical element characterized by having a specular reflection layer on one side of a layered product which comes to prepare a polarization scattered plate in which distributed content of the minute field of birefringence is carried out, and a dispersion anisotropy is shown according to the polarization direction in one side or both sides of a translucency resin board which made a luminescent material contain.

[Claim 2] An optical element which consists of a fluorescence material or a light storage material with which a luminescent material absorbs ultraviolet rays or the light, and emits phosphorescence of the light or the light in claim 1.

[Claim 3] An optical element which is what carries out distributed content of the minute field where a polarization scattered plate consists of a liquid crystal polymer with a glass transition temperature of 50 degrees C or more which presents a nematic liquid crystal layer at low temperature rather than glass transition temperature of polymer which forms the film into a bright film in claim 1 or 2.

[Claim 4] The plane-of-polarization light source characterized by coming to arrange the light source on the at least 1 side of an optical element according to claim 1 to 3.

[Claim 5] A liquid crystal display characterized by providing a lighting system which comes to use an optical element according to claim 1 to 3.

[Claim 6] A liquid crystal display with which a lighting system consists of what has the light source on the at least 1 side of a translucency resin board in an optical element in claim 5.

[Claim 7] A liquid crystal display with which an optical element consists of a translucency resin board which has 120% or more of area to a part for a display of a liquid crystal display, a polarization scattered plate which has 90 - 110% of area, and a laminating unification object with a specular reflection layer in claim 5 or 6.

[Claim 8] A liquid crystal display in the condition that a portion which does not have a polarization scattered plate of a translucency resin board makes it an outside of housing of a liquid crystal display in claim 7, and outdoor daylight can make incidence to a projection and its lobe.

---

[Translation done.]

## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

## [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the plane-of-polarization light source and the liquid crystal display using the optical element and it to which the linearly polarized light carries out outgoing radiation of the light which carried out excitation luminescence through the incident light from the side or a table rear face where a plane of vibration is controlled from one side on the rear face of a table.

[0002]

[Background of the Invention] Conventionally, that to which the optical outgoing radiation means which becomes a translucency resin board from the reflective dot of high reflection factor pigment content of titanium oxide, a barium sulfate, etc. is formed as a side light mold light guide plate which can be used as a back light of a liquid crystal display, and it was made to carry out outgoing radiation of the transmission light by the total reflection in a board from one side of \*\*\*\*\* by dispersion etc. through the optical outgoing radiation means was known. However, most aforementioned outgoing radiation light was the natural lights which do not show a polarization property, and since there was the need of changing it into the linearly polarized light through a polarizing plate on the occasion of a liquid crystal display, they had the trouble that the absorption loss by the polarizing plate was produced and utilization effectiveness of light could not exceed 50%.

[0003] in view of the above, the system which uses together the polarization conversion means which combined the polarization division plate from which the linearly polarized light is acquired using a BURYU star angle, and the phase contrast board is proposed (JP,6-18873,A —) JP,6-160840,A, JP,6-265892,A, JP,7-72475,A, JP,7-261122,A, JP,7-270792,A, JP,9-54556,A, JP,9-105933,A, JP,9-138406,A, a JP,9-152604,A official report, JP,9-293406,A, JP,9-326205,A, JP,10-78581,A, etc. However, polarization sufficient in this back light was not acquired, but since control of the polarization direction was also difficult, the scarce difficulty was in practicability.

[0004]

[The technical technical problem of invention] The outgoing radiation light which consists of the linearly polarized light is obtained, and this invention can also control the polarization direction (plane of vibration) to arbitration, and makes a technical problem development of the optical element which can also use utilization of outdoor daylight as a possible light guide plate etc.

[0005]

[Means for Solving the Problem] This invention to one side or both sides of a translucency resin board which made a luminescent material contain An optical element characterized by having a specular reflection layer on one side of a layered product which comes to prepare a polarization scattered plate in which distributed content of the minute field of birefringence is carried out, and a dispersion anisotropy is shown according to the polarization direction, And the plane-of-polarization light source characterized by coming to arrange the light source on the at least 1 side of the optical element and a liquid crystal display characterized by providing a lighting system which comes to use the aforementioned optical element for a list are offered.

[0006]

[Effect of the Invention] According to this invention, outgoing radiation can be carried out efficiently as the linearly polarized light, and the linearly polarized light of the oscillating direction corresponding to it while it did not have a specular reflection layer on the rear face of a table for the excitation light by the outdoor daylight which carried out incidence from the natural light which did not need to form special optical outgoing radiation means, such as a reflective dot, in the translucency resin board by the above-mentioned configuration, and carried out incidence from the side, or the front reverse side can be acquired through the optical axis of the polarization scattered plate of concomitant use. Therefore, the oscillating direction of the linearly polarized light is changeable into arbitration by optical-axis control of a polarization scattered plate. Moreover, the light which the translucency resin board was made to project from a liquid crystal display, and carried out incidence to the lobe can be supplied as the linearly polarized light to a part for a display, and a display bright also at a taper can be attained.

[0007] In the above, namely, the great portion of excitation light by the incident light from the side or the front reverse side To a polarization scattered plate, total reflection being carried out by the refractive-index difference with an air interface, and transmitting the inside of a translucency resin board The inside of the incident light of incidence *Perilla frutescens* (L.) Britton var. *crispa* (Thunb.) Decne., It is scattered about strongly selectively, the part serves as an angle smaller than a total reflection angle, and the linearly polarized light which has a plane of vibration parallel to the shaft orientations (\*\*n1 direction) which show the maximum refractive-index difference

(\*\*n1) with a minute field carries out outgoing radiation from an optical element. In that case, in the side which prepared the specular reflection layer, as a result of [ whole surface / of an optical element ] interrupting outgoing radiation, supplying a reverse side and concentrating outgoing radiation light on the field (front reverse side one [ which does not have a specular reflection layer ] field of an optical element), the linearly polarized light carries out outgoing radiation.

[0008] Incidentally excitation luminescence by the luminescent material in a translucency resin board is in the condition which about 80% was shut up into this resin board, and has repeated total reflection on the relation of a solid angle. Only when total reflection conditions are destroyed by dispersion by the above mentioned polarization scattered plate, in order to carry out outgoing radiation of the shut-up light from an optical element, it becomes possible to make the area portion of a polarization scattered plate, as a result its area correspond, and to centralize outgoing radiation light of it only on a part for the display of a liquid crystal display element. The light which did not receive dispersion on the other hand although it was satisfied with dispersion of the \*\*n1 aforementioned direction of the light scattered about at the large angle and the \*\*n1 direction conditions, and the light which, in addition, has the oscillating directions other than the \*\*n1 direction It is transmitted being shut up in a translucency resin board and repeating total reflection, a polarization condition is also canceled by the birefringence phase contrast by the polarization scattered plate etc., and it waits for an opportunity to satisfy and carry out outgoing radiation of the aforementioned \*\*n1 direction conditions. Outgoing radiation of the linearly polarized light of a predetermined plane of vibration is efficiently carried out by the above repeat from an optical element.

[0009]

[Embodiment of the Invention] The optical element by this invention has a specular reflection layer on one side of the layered product which comes to prepare the polarization scattered plate in which distributed content of the minute field of birefringence is carried out, and a dispersion anisotropy is shown according to the polarization direction in one side or both sides of a translucency resin board which made luminescent material contain. The example was shown in drawing 1. 1 is a translucency resin board, 3 is a polarization scattered plate, 4 is those layered products, and 5 is a specular reflection layer. In addition, 2, 6, and 7 are a glue line as occasion demands, a lens sheet, and an optical diffusion layer, respectively. In addition, <A HREF="/Tokujitu/tjitemdrw.ipdl?N0000=237&N0500=1E\_N/;>=<6 <7///&N0001=102&N0552=9&N0553=000006" TARGET="tjitemdrw"> drawing 1 has illustrated what was made into the plane-of-polarization light source, and 8 is the light source.

[0010] A translucency resin board should just be the tabular object formed in it using one sort of the proper material in which transparency is shown, or two sorts or more according to the wavelength region of the light source. Incidentally the board which consists of for example, acrylic resin, polycarbonate system resin, styrene resin, norbornene system resin, epoxy system resin, etc. can use preferably in a light region. The board with which a refractive index consists of small resin as much as possible is more desirable than the point of light transmittance. Moreover, rather than the point of maintaining the polarization property of outgoing radiation light, in case a small resin board has the as much as possible desirable phase contrast of field inboard and a board is fabricated rather than this point, the material which cannot produce the orientation birefringence by distortion etc. easily, especially the poly methyl meta-rate, norbornene system resin, etc. can use preferably. This resin is excellent also in the moldability of a board.

[0011] the configuration of a translucency resin board — a liquid crystal display — according to equalization of the size of the liquid crystal cell, the property of the light source, and the brightness of outgoing radiation light etc., it can determine suitably above all, and there is especially no definition. Although a plate, a wedge-shaped board, etc. are more desirable than points, such as the ease of shaping, according to the housing configuration for [ such as a liquid crystal display ] application etc., it can consider as a free form. When the telephone body itself incidentally consists of a translucency material like a skeleton type with a cellular phone etc., it can also consider as the structure where the body serves as a translucency resin board etc.

[0012] Although it can determine suitably according to the light source, the size of a liquid crystal cell, etc. also about the thickness of a translucency resin board and there is especially no definition, a thing thin as much as possible for the purpose of the formation of thin lightweight etc. is desirable, and 0.5–5mm is especially desirable 10mm or less above all. When aiming at furthermore improving lightning in ambient lights, such as outdoor daylight, it is desirable to consider as the translucency resin board of a larger area than the size of the screen (liquid crystal cell) of a liquid crystal display.

[0013] A method with proper for example, injection-molding method, cast-molding method, an extrusion-molding method and a flow casting shaping method, a rolling shaping method and a roll coating shaping method, transfer-molding method, reaction-injection-molding method (RIM), etc. can perform formation of a translucency resin board. A luminescent material is blended on the occasion of the formation, and proper additives, such as an antitamish agent, an antioxidant, an ultraviolet ray absorbent; and a release agent, can be blended further if needed.

[0014] One sort of the proper material which absorbs ultraviolet rays or the light and carries out excitation luminescence of the wavelength light of a light field as the luminescent above mentioned material which a translucency resin board is made to contain, or two sorts or more can be used, and there is especially no limit. It consists of organic dye, an inorganic pigment, etc. which emit the phosphorescence which is the fluorescence and luminescence from 3-fold term which are incidentally luminescence from an one-fold excitation term as the example, for example, a fluorescence material, a light storage material, etc. by JP,3-40293,B etc. are raised.

[0015] As for a luminescent material, it is more desirable than points, such as homogeneity luminescence, to carry out homogeneity distribution as much as possible into a translucency resin board, and its thing small as much as

possible than the point of control of unnecessary dispersion is [ the size of the distributed object ] desirable. In case distribution of the luminescent material to the inside of a translucency resin board forms for example, a translucency resin board, a method with the proper method which blends the luminescent material with the molding resin with other additives if needed beforehand can perform it.

[0016] The proper thing which carries out distributed content of the minute field of birefringence as a polarization scattered plate, and shows a dispersion anisotropy according to the polarization direction on the other hand can be used. Incidentally as the example, what carried out distributed content of the minute field of birefringence is raised into a bright film. A method with the proper method which uses in the combination which forms the field from which birefringence is different by the proper orientation processing by drawing processing etc. in one sort of the proper material which is excellent in transparency, such as for example, polymer and liquid crystal, or two sorts or more, and obtains an oriented film can perform the formation.

[0017] Incidentally as the aforementioned example of combination, the combination of polymer and liquid crystal, the combination of isotropic polymer and anisotropy polymer, the combination of anisotropy polymer, etc. are raised. The combination which carries out phase separation is more desirable than points, such as the distributed distribution nature of a minute field, and distributed distribution nature can be controlled by the compatibility of the material to combine. A method with proper method which solution-izes the material of for example, non-compatibility with a solvent, method which mixes the material of non-compatibility under heating melting can perform phase separation.

[0018] When carrying out orientation processing with a drawing method in the aforementioned combination, in the combination of polymer and liquid crystal, and the combination of isotropic polymer and anisotropy polymer, the target polarization scattered plate can be formed by controlling drawing conditions suitably with the combination of anisotropy polymer by arbitrary drawing temperature and draw magnification. in addition — although classified into positive/negative according to anisotropy polymer based on the property of refractive-index change of the drawing direction — this invention — setting — positive/negative — any anisotropy polymer — it can use — any of the combination of positive, negative, or positive/negative — even if — it can use.

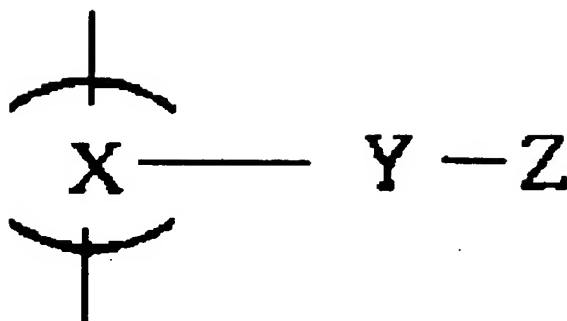
[0019] As the above mentioned example of polymer, the ester system polymer like polyethylene terephthalate or polyethylenenaphthalate, Polystyrene and the styrene system polymer like an acrylonitrile styrene copolymer (AS polymer), The olefin system polymer like polyolefine or ethylene propylene rubber which has polyethylene, polypropylene, a cyclo system, or norbornene structure, Acrylic polymer, the cellulose type polymer like diacetyl cellulose or a cellulose triacetate, and nylon and the amide system polymer like aromatic polyamide like polymethylmethacrylate are raised.

[0020] Moreover, carbonate system polymer, vinyl chloride system polymer, imide system polymer and sulfone system polymer, Polyether sulphone, a polyether ether ketone, a polyphenylene sulfide and vinyl alcohol system polymer, Vinylidene-chloride system polymer, vinyl butyral system polymer, ant rate system polymer, and polyoxymethylene, Silicone system polymer, urethane system polymer, ether system polymer and vinyl acetate system polymer, It is raised as an example of the transparency polymer which described above the polymer of heat-curing molds, such as the blend object or phenol system of said polymer, a melamine system, acrylic and an urethane system, urethane acrylic and an epoxy system, and a silicone system, thru/or an ultraviolet curing mold.

[0021] On the other hand, as an example of liquid crystal, the liquid crystal polymer which presents a nematic phase and a smectic phase is raised with the low-molecular liquid crystal which presents a nematic phase and a smectic phase at the room temperature or elevated temperature like a cyano biphenyl system, a cyanophenyl cyclohexane system, a cyanophenyl ester system and a benzoic-acid phenyl ester system, phenyl pyrimidine systems, or those mixture, a cross-linking liquid crystal monomer, a room temperature, or an elevated temperature. Usually, after the aforementioned cross-linking liquid crystal monomer carries out orientation processing, bridge formation processing is carried out by the proper method by heat, light, etc., and let it be polymer.

[0022] It is more desirable than especially the point of obtaining the polarization scattered plate which is excellent in thermal resistance, endurance, etc. that glass transition temperature uses 50 degrees C or more 80 degrees C or more above all in combination with polymer 120 degrees C or more, and a cross-linking liquid crystal monomer thru/or a liquid crystal polymer. As the liquid crystal polymer, proper things, such as a principal chain mold and a side-chain mold, can be used, and there is especially no definition about the class. The polymerization degree of especially the liquid crystal polymer that can be used more preferably than the points of excelling in the homogeneity of particle size distribution, such as the plasticity of a minute field, thermal stability, a moldability to a film, and the ease of orientation processing, is the thing of 15-5000 ten or more above all eight or more.

[0023] One sort of the liquid crystal polymer for forming one sort or two sorts or more, and minute field of for example, polymer or two sorts or more can be mixed, the polymer film which carries out distributed content of the liquid crystal polymer in the state of a minute field can be formed, orientation processing can be carried out by the proper method, and formation of the polarization scattered plate using a liquid crystal polymer can be performed by the method of forming the field from which birefringence is different etc. What glass transition temperature is 50 degrees C or more, and presents a nematic liquid crystal phase in a temperature region lower than the glass transition temperature of the polymer of concomitant use rather than points, such as the controllability of the above-mentioned refractive-index difference  $n_1$  by orientation processing and  $n_2$ , can use preferably. The liquid crystal polymer of a side-chain mold which has the monomeric unit incidentally expressed with the following general formula as the example is raised.

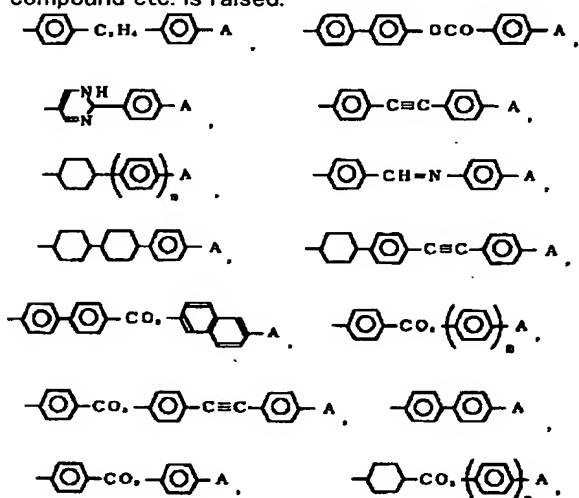


[0024] General formula :

[0025] In the aforementioned general formula, X is a frame radical which forms the principal chain of a liquid crystal polymer, and may be formed in proper joining chains, such as a line, a letter of branching, and annular. Incidentally as the example, polyacrylates, polymethacrylates, Polly alpha-halo acrylate and Polly alpha-cyanoacrylate, polyacrylamides and polyacrylonitriles, the poly methacrylonitriles and polyamides, polyester and polyurethane, polyethers, polyimide and polysiloxanes, etc. are raised.

[0026] Moreover, Y is a spacer radical which branches from a principal chain, and the spacer radicals Y more desirable than points, such as the plasticity of polarization scattered plates, such as refractive-index control, are ethylene, a propylene and a butylene, pentene, hexylene and octylene, decylene and undecylene, dodecylene and OKUTA decylene, ethoxyethylene, a methoxy butylene, etc.

[0027] On the other hand, Z is a meso gene radical which gives a liquid crystal stacking tendency, and the following compound etc. is raised.



[0028] The halo alkyl group and haloalkoxy radical by which one or more of a cyano group, an alkyl group, an alkenyl radical, an alkoxy group, an OKISA alkyl group, or hydrogen were replaced with a fluorine or chlorine, the halo alkenyl radical of the end substituent A in said compound, etc. may be proper.

[0029] In the above, the spacer radical Y and the meso gene radical Z may be combined through ether linkage, i.e., -O-. Moreover, its one piece or two hydrogen may be replaced by the halogen, and the phenyl group in the meso gene radical Z has chlorine or a desirable fluorine as a halogen in that case.

[0030] As for the side-chain mold liquid crystal polymer of the above-mentioned nematic stacking tendency, what is excellent in a mono-domain stacking tendency above all is [ that what is necessary is just proper thermoplastic polymer, such as a homopolymer a copolymer, etc. which have the monomeric unit expressed with the aforementioned general formula, ] desirable.

[0031] Formation of the polarization scattered plate using the liquid crystal polymer of a nematic stacking tendency The glass transition temperature which presents a nematic liquid crystal phase in a temperature region lower than the glass transition temperature of the polymer and polymer for forming a polymer film For example, 50 degrees C or more, After forming above all 60 degrees C or more of polymer films which mix especially a liquid crystal polymer 70 degrees C or more, and carry out distributed content of the liquid crystal polymer in the state of a minute field, The liquid crystal polymer which forms the minute field can be heat-treated, orientation can be carried out to a nematic liquid crystal phase, and the orientation condition can be performed by the method of carrying out cooling immobilization etc.

[0032] Formation of the polymer film which carries out distributed content of the above-mentioned minute field, i.e., the film of an orientation processing object, can be obtained by proper methods, such as for example, the casting method, an extrusion method, an injection-molding method, and roll diffusion bonding, the flow casting fabricating method, and the method which develops in the state of a monomer, carries out the polymerization of it by radiation treatment, such as heat-treatment and ultraviolet rays, etc., and produces a film in the shape of a film can perform

it.

[0033] The method which produces the mixed liquor of the formation material through a solvent by the casting method, the flow casting fabricating method, etc. is more desirable than the point of obtaining the polarization scattered plate which is excellent in the equal distribution nature of a minute field etc. In that case, minute area size, distribution nature, etc. are controllable by the class of solvent, the viscosity of mixed liquor, the rate of drying of a mixed liquor expansion layer, etc. Incidentally hypoviscosity-izing of mixed liquor, acceleration of the rate of drying of a mixed liquor expansion layer, etc. are advantageous to the formation of small area of a minute field.

[0034] Although the thickness of the film of an orientation processing object can be determined suitably, especially generally it is set to 10–500 micrometers 5 micrometers – 1mm above all 1 micrometer – 3mm from points, such as orientation processability. In addition, on the occasion of formation of a film, proper additives, such as a dispersant, a surfactant, an ultraviolet ray absorbent, a color tone modifier, a flame retarder, and a release agent, an antioxidant, can be blended, for example.

[0035] As described above, orientation processing For example, one shaft, biaxial, drawing mode of processing and a rolling method according to biaxial, the Z-axis, etc. serially, The method which impresses and quenches electric field or a magnetic field at the temperature more than glass transition temperature or liquid crystal transition temperature, and fixes orientation, and the method which carries out floating orientation at the time of film production, It can carry out using one sort of the proper method which can control a refractive index by orientation, such as a method to which self-orientation of the liquid crystal is carried out based on the slight orientation of isotropic polymer, or two sorts or more. Therefore, the obtained polarization scattered plate may be an oriented film, and may be a non-oriented film. In addition, although brittle polymer can also be used when considering as an oriented film, the polymer which is excellent in stretch nature can use preferably especially.

[0036] Moreover, melting can be heated and carried out to the temperature which presents the liquid crystal phase which the liquid crystal polymer which carries out distributed distribution as a minute field makes the object of nematic equality for example, into a polymer film in consisting of a liquid crystal polymer which the minute field described above, orientation of it can be carried out to the bottom of an operation of orientation restraining force, it can quench, and the method which fixes an orientation condition can perform. As for the orientation condition of a minute field, it is more desirable than points, such as variation prevention of an optical property, that it is in a mono-domain condition as much as possible.

[0037] In addition, the proper restraining force which is made to carry out orientation of the liquid crystal polymers, such as drawing force by the method which carries out drawing processing of the polymer film, for example for a proper scale factor, share ring force at the time of film formation, electric field, and a magnetic field, and deals in them as the aforementioned orientation restraining force can be applied, one sort or two sorts or more of the restraining force can be made to be able to act, and orientation processing of a liquid crystal polymer can be performed.

[0038] Therefore, portions other than the minute field in a polarization scattered plate may show birefringence, and may be isotropic things. That the whole polarization scattered plate indicates birefringence to be can be obtained by the molecular orientation in the film production process which used and described the thing of orientation birefringence above to the polymer for film formation etc., can add well-known orientation means, such as drawing processing, if needed, for example, can give thru/or control birefringence. Moreover, portions other than a minute field can obtain an isotropic polarization scattered plate using an isotropic thing with the method which carries out drawing processing of the film in the temperature field below the glass transition temperature of the polymer concerned to the polymer for for example, film formation.

[0039] The portion with the as other polarization scattered plate which can be used preferably as a minute field, i.e., the portion which it becomes from a polymer film Refractive-index difference  $n_1$  in each optical-axis direction of a minute field,  $n_2$ , and  $n_3$  are 0.03 ( $n_1$ ) or more in the shaft orientations ( $n_1$  direction) which show maximum. And it controls to become 50% or less ( $n_2$ ,  $n_3$ ) of the aforementioned  $n_1$  in the biaxial direction ( $n_2$ -way,  $n_3$  direction) which intersects perpendicularly with the  $n_1$  direction and which remains, and the equal of  $n_2$  and  $n_3$  is more desirable.

[0040] By considering as the aforementioned refractive-index difference, the quantity of light which the linearly polarized lights of  $n_1$  direction are scattered about strongly, are scattered about at an angle smaller than a total reflection angle, and carries out outgoing radiation from an optical element can be increased, and the linearly polarized lights of the other direction cannot be scattered about easily, and can shut up total reflection in a repeat and an optical element.

[0041] In the above in addition, the refractive-index difference of each optical-axis direction of a minute field, and portions other than a minute field When the polymer which forms a film is the thing of the optical isotropy When the polymer which means the difference of the refractive index of each optical-axis direction of a minute field and the average refractive index of a polymer film, and forms a film is the thing of optical anisotropy Since the direction of the main optical axis of a polymer film and the direction of the main optical axis of a minute field are usually in agreement, the difference of each refractive index in each shaft orientations is meant.

[0042] The moderately large thing of refractive-index difference  $n_1$  in  $n_1$  direction is desirable, and it is more desirable than the point of the above mentioned total reflection 0.035–1, and that it is especially refractive-index difference  $n_1$  of 0.045–0.5 above all. The moderately small thing of refractive-index difference  $n_2$  in  $n_2$ -way and  $n_3$  direction and  $n_3$  is desirable. This refractive-index difference is controllable by the refractive index of the material of construction, the above-mentioned orientation actuation, etc.



[0043] Moreover, as for this  $n_1$  direction, it is more desirable than the  $n_1$  aforementioned direction is the plane of vibration of the linearly polarized light by which outgoing radiation is carried out from an optical element that it is parallel to a polarization scattered plate side. In addition, this  $n_1$  direction of [ within a field ] can be made into the proper direction according to the liquid crystal display made into the object.

[0044] As for the minute field in a polarization scattered plate, it is more desirable than points [ , such as homogeneity, ], such as said scattering effect, to carry out distributed distribution uniformly as much as possible. The  $n_1$  lay length which is minute area size, especially the dispersion direction is related to a backscattering (echo) or a wavelength dependency.

[0045] Improvement in efficiency for light utilization, prevention of coloring by the wavelength dependency, prevention of the check-by-looking inhibition by the vision of a minute field or clear inhibition prevention of a display, magnitude with a minute field still more desirable than points, such as film production nature and film reinforcement, and the 0.05–500 micrometers especially of the 0.1–250 micrometers especially of the desirable length of  $n_1$  direction are 1–100 micrometers above all. In addition, although a minute field exists in a polarization scattered plate in the state of a domain usually, there is especially no definition about lengths, such as the  $n_2$  2-way.

[0046] Although the rate of the minute field occupied in a polarization scattered plate can be determined more suitably than points, such as the dispersion nature of  $n_1$  direction, generally it is based on film reinforcement etc. and is especially made into 1 – 30 % of the weight 0.5 to 50% of the weight above all 0.1 to 70% of the weight.

[0047] A polarization scattered plate can also be formed in the monolayer of the film in which the above-mentioned birefringence property is shown, and can also be formed as what superimposed this film more than two-layer. By superposition-ization of the film concerned, the multiplication-scattering effect beyond the increment in thickness can be demonstrated. Although a superposition object may superimpose the film concerned at arbitrary arrangement angles, such as  $n_1$  direction or  $n_2$  2-way, what was superimposed so that  $n_1$  direction might serve as parallel relation from points, such as amplification of a scattering effect, in an up-and-down layer is desirable. The number of superposition of the film concerned can be made into the proper number more than two-layer.

[0048] The film concerned to superimpose may have  $n_1$  or the same  $n_2$  grade, and may differ. In addition, although the as much as possible parallel thing of the parallel relation in the layer of the upper and lower sides in  $n_1$  direction etc. is desirable, the gap by the activity error etc. is permitted. Moreover, when there is variation in the  $n_1$  direction etc., it is based in the average direction.

[0049] The film concerned in a superposition object is pasted up through a glue line etc. so that a total reflection interface may turn into the maximum front face. Proper adhesives, such as for example, a hot melt system and an adhesion system, can be used for the adhesion. Rather than the point which controls reflection loss, as much as possible, the small glue line of a refractive-index difference with the film concerned is desirable, and it can also paste up in the polymer which forms a film and its minute field concerned.

[0050] In addition, a polarization scattered plate has the thing [ board / whole ] more desirable than a polarization condition needs to be suitably canceled in the process in which light transmits the inside of an optical element for which it is or has phase contrast selectively. Although the polarization conversion by phase contrast cannot break out easily since the lagging axis of a polarization scattered plate and the polarization shaft (plane of vibration) of the linearly polarized light which cannot be scattered about easily are in orthogonality relation fundamentally, an apparent angle changes with slight dispersion and it is thought that polarization conversion arises.

[0051] Although it is more desirable than the point of the above mentioned polarization conversion that there is generally phase contrast within a field 5nm or more, the value changes with the thickness of a polarization scattered plate. In addition, a method with proper method which makes the particle of birefringence contain, method made to adhere to a front face, method which makes a polymer film birefringence, method which uses them together can perform grant of the phase contrast.

[0052] Although the layered product of the translucency resin board of luminescent material content and a polarization scattered plate is used for the optical element by this invention As illustrated to drawing 1 on the occasion of the formation, in order to control the echo by the interface of the translucency resin board 1 and the polarization scattered plate 3 as much as possible, That is, in order to attain the total reflection on the rear face of a table of a layered product which makes easy transparency of the transmission light between a translucency resin board and a polarization scattered plate, and really [ those / adhesion ] consists of an object, it is desirable to have pasted up with adhesives with a near refractive index etc. as much as possible. Adhesion processing is more effective than points, such as gap prevention of axial relation. In addition, on the occasion of formation of an optical element, as illustrated to drawing 2 , the polarization scattered plate 3 can also be formed in front reverse side both sides of the translucency resin board 1.

[0053] The aforementioned adhesion processing can use proper adhesives, such as transparent binders, such as acrylic, a silicone system, a polyester system and a polyurethane system, a polyether system, and a rubber system, according to the polarization scattered plate of the above-mentioned superposition mold, and there is especially no definition. What neither hardening nor desiccation takes \*\*\*\*\*, and hardening and desiccation processing of long duration for an elevated-temperature process is more desirable than the point of preventing change of an optical property etc. Moreover, what does not produce exfoliation problems, such as a float and peeling, under the condition of heating or humidification is desirable.

[0054] The acrylic binder with which the weight average molecular weight which comes to copolymerize the acrylic monomer which carbon numbers, such as a methyl group, an ethyl group, and butyl, become from amelioration



components, such as alkyl ester of the acrylic acid which has 20 or less alkyl group (meta), and an acrylic acid (meta), acrylic-acid (meta) hydroxyethyl, from the aforementioned point in the combination from which glass transition temperature becomes 0 degree C or less makes 100,000 or more acrylic polymers base polymer is used preferably. The acrylic binder also has the advantage which is excellent in transparency, weatherability, thermal resistance, etc.

[0055] A proper method can perform the attachment of the adhesive layer to a translucency resin board or/and a polarization scattered plate. Make the solvent which consists of the independent object or mixture of a proper solvent, such as toluene and ethyl acetate, as the example dissolve or distribute a binder component, and about 10 - 40% of the weight of binder liquid is prepared. The method which attaches it directly on a translucency resin board or a polarization scattered plate by proper expansion methods, such as a flow casting method and a coating method, or the method which forms an adhesive layer on a separator according to the above, and carries out transfer of it on a translucency resin board or a polarization scattered plate is held. The adhesive layer to prepare may be a superposition layer of things, such as a different presentation or a class.

[0056] The thickness of a glue line can be suitably determined according to adhesive strength etc., and, generally is set to 1-500 micrometers. Proper additives, such as a bulking agent which consists of the resin of a natural product or a compost, a glass fiber, a glass bead and a metal powder, other inorganic powder, etc. if needed, a pigment and a coloring agent, and an antioxidant, can also be blended with a glue line.

[0057] The specular reflection layer 5 prepared in one side of the layered product 4 of the translucency resin board 1 and the polarization scattered plate 3 like instantiation at drawing 1 aims at reversing the light which carries out outgoing radiation from the reflecting layer arrangement side, without changing a polarization condition through a specular reflection layer, centralizing outgoing radiation light on one side on the rear face of a table of an optical element, and raising brightness.

[0058] As the aforementioned reflecting layer, it is desirable that it is a mirror plane as much as possible than the point of maintenance of a polarization condition, and the reflector which consists of a metal or a dielectric multilayer from this point is desirable. As the metal, proper things, such as aluminum, silver, chromium metallurgy, copper and tin, zinc, an indium and palladium, and platinum or its alloy, can be used.

[0059] Although a specular reflection layer can also be directly stuck to a layered product as an attachment layer of the metal thin film by a vacuum evaporation method etc., a full echo is difficult, and the arrangement method with which only the air space which only piles up a reflecting plate and places it may intervene is more desirable than the point of we being anxious about absorption loss if some absorption by the reflecting layer arises too and the repeat by total reflection is taken into consideration, and preventing it.

[0060] Therefore, tabular things, such as a reflecting plate which attached the metal thin film to for example, the support base material by the sputtering method, the vacuum evaporation method, etc., and a rolling sheet of a metallic foil metallurgy group, can use a specular reflection layer preferably from this point. Proper things, such as a glass plate and a resin sheet, can be used for the above-mentioned support base material of a reflecting layer. Above all, what was vapor-deposited on the resin sheet can use silver, aluminum, etc. preferably from points, such as a reflection factor, and a tint, handling nature. Moreover, about the specular reflection layer which consists of a dielectric multilayer, it can apply to a well-known example (for example, \*\*\*\*\* No. 511322 [ ten to ] official report) etc. correspondingly. In addition, a reflecting layer may be arranged to any of the front reverse side of a layered product.

[0061] On the other hand, in the field which does not arrange, the reverse side, i.e., aforementioned specular reflection layer, of a layered product, proper optical layers, such as the lens sheet 6 of polarization maintenance nature and the optical diffusion board 7, can also be arranged like the example of drawing 1 if needed. This lens sheet carries out optical-path control of the outgoing radiation light (linearly polarized light) of the dispersion nature from a layered product, maintaining the degree of polarization as much as possible, raises the directivity to the direction of a transverse plane advantageous to a check by looking, and aims at making the outgoing radiation luminous-intensity peak of dispersion nature into the direction of a transverse plane etc.

[0062] The proper thing which carries out optical-path control and was [ a sheet side ] made to carry out outgoing radiation of the scattered light which carried out incidence from one side (rear face) as a lens sheet efficiently in the vertical (transverse plane) direction as much as possible on the other hand (front face) can be used, and there is especially no definition. Therefore, anything that has various kinds of lens gestalten of an activity with the conventional side light mold light guide plate except for the point of polarization maintenance nature can be used (for example, JP,5-169015,A etc.). It excels in whenever [ light transmission ] so that according [ the lens sheet used preferably ] to depolarization for example when all [ 90% or more of ] light transmission is shown especially 85% or more above all 80% or more and it has arranged between crossing Nicol's prisms leakage light (permeability) may be especially 1% or less 2% or less above all 5% or less, and the polarization property of outgoing radiation light is not canceled as much as possible.

[0063] From generally the dissolution of polarization arising by the birefringence or multiple scattering, for example, the lens sheet in which the above mentioned polarization maintenance nature is shown It can attain reducing a birefringence as much as possible, by reducing the count of an average echo (dispersion) in the locus of a beam of light, etc. The inside of polymer \*\* illustrated with the translucency resin board specifically described above or the polarization scattered plate, The low resin (good resin of the optical isotropy) of the birefringence like cellulose-triacetate system resin, a polymethyl methacrylate and a polycarbonate, or norbornene system resin can be obtained with one sort or the method which uses two or more sorts and forms a lens sheet.

[0064] The lens field of a convex lens mold or a refractive-index distribution pattern (GI mold) which comes to control a refractive index the front face or inside a transparent resin base material through a photopolymerization object etc. as a lens sheet as mentioned above, [ which may contain the resin from which a refractive index is different, for example ] What formed many minute lens fields especially, and the thing which filled up with the polymer of a refractive-index difference the breakthrough of a large number prepared in the transparent resin base material, and formed the lens field, Or although it has proper lens gestalten, such as what carried out monolayer arrangement of many spherical lenses, and fixed it with the thin film What has the lens gestalt 61 which becomes drawing 1 from concavo-convex structure like instantiation at one side of a sheet 6 or both sides, especially one side is more desirable than the point of the optical-path control through a difference of a refractive index etc.

[0065] That the concavo-convex structure which forms the aforementioned lens gestalt should just be what demonstrates the function which controls the optical path of the light which penetrated the sheet and condenses the transmitted light in the direction of a transverse plane For example, what the minute cone-like projection which has base configurations, such as a thing which linear slots, such as a cross-section triangle, and a projection arranged the shape of a stripe and in the shape of a grid or a triangular pyramid and a rectangular-head drill, other multiple drills, and a cone, arranged to punctiform is raised. In addition, the concavo-convex structures of linear or punctiform may be a spherical lens, an aspheric lens, a semicircle cylinder lens, etc., and may have a proper lens gestalt.

[0066] A method with the proper method which carries out heating sticking by pressure of the resin sheet at the method which fills up with resin liquid or the monomer for resin formation the mold formed so that concavo-convex predetermined structure might be formed, carries out polymerization if needed, and imprints the type concerned of concavo-convex structure, or the mold concerned, and imprints the concavo-convex structure can perform formation of the lens sheet which has the above mentioned concavo-convex structure of linear or punctiform. In addition, the lens sheet may be formed as a superposition layer more than the bilayer [ like ] of a resin layer of the same kind or of a different kind etc., although the lens gestalt was added to the support sheet.

[0067] A lens sheet can be arranged one layer or more than two-layer to the optical outgoing radiation side of a layered product. When arranging more than two-layer, the lens sheet may be the same, and although it differs, the thing [ holding polarization maintenance nature as a whole ] is desirable. When the lens sheet to arrange will adjoin a layered product, it is desirable to be arranged so that an opening may be generated to a layered product like the case of the above-mentioned specular reflection layer. Moreover, the thing large more fully than the wavelength of incident light of the opening is more desirable than the point of total reflection.

[0068] In addition, when the lens gestalt in a lens sheet consists of linear concavo-convex structure, it is desirable to arrange so that the direction of a line may be in the direction of an optical axis of a polarization scattered plate (the direction of a plane of vibration of outgoing radiation polarization), a parallel condition, or a rectangular condition from points, such as optical-path control to the direction of a transverse plane. Moreover, when arranging this lens sheet more than two-layer, it is more desirable than the point of the effectiveness of optical-path control to arrange so that the direction of a line may cross in an up-and-down layer.

[0069] An optical diffusion board aims at diffusing outgoing radiation light (linearly polarized light), maintaining the degree of polarization as much as possible, equalizing luminescence, or easing the vision of the pattern of a lens sheet, and raising visibility etc. An optical diffusion board can be replaced with a lens sheet, or can arrange one layer or more than two-layer in proper locations, such as between a lens sheet and a layered product or an optical outgoing radiation side of a lens sheet.

[0070] As an optical diffusion layer, it excels in whenever [ light transmission ] according to the above-mentioned lens sheet, and what maintains the polarization property of outgoing radiation light as much as possible is used preferably. Therefore, the optical diffusion layer of this polarization maintenance nature can be acquired as what resin with the small rate of a birefringence illustrated with the above-mentioned lens sheet is preferably used for formation of an optical diffusion layer, for example, carries out distributed content of the transparence particle into the resin layer, a resin layer which has detailed irregularity structure on a front face.

[0071] in addition, as a transparence particle which carries out distributed content, in the aforementioned resin layer For example, a silica thru/or glass and an alumina, a titania and a zirconia, tin oxide, and indium oxide, The conductive thing which consists of cadmium oxide, antimony oxide, etc. A certain inorganic system particle, Or acrylic polymer, a polyacrylonitrile, polyester and epoxy system resin, Melamine system resin, urethane system resin, a polycarbonate and polystyrene, The organic system particle which consists of polymer for which a bridge is not constructed [ the bridge formation like silicone system resin, benzoguanamine and a melamine benzoguanamine condensate, or a benzoguanamine formaldehyde condensate or ] is raised.

[0072] One sort or two sorts or more can be used for a transparence particle, and 1-20 micrometers of particle size are more desirable than points, such as the diffusibility of light, and the uniformity of the diffusion. On the other hand, although the grain shape is arbitrary, generally a globular form (truth), its secondary floc, etc. are used. Especially rather than the point of polarization maintenance nature, the transparence particle of 0.9-1.1 can use [ a refractive-index ratio with resin ] preferably. The optical diffusion layer of particle content can be formed by the proper method according to the former, such as a method which mixes a transparence particle in the melting liquid of resin, and carries out extrusion molding to a sheet etc., a method which blends a transparence particle with the solution and the monomer of resin, casts for a sheet etc., and carries out polymerization if needed, and a method which carries out coating of the resin liquid of transparence particle content to a predetermined side, the support film of polarization maintenance nature, etc.

[0073] On the other hand, a method with proper method which split-face-izes the front face of the sheet which consists of resin with buff processing, an embossing method, etc. by sandblasting etc., method which forms in the front face of the sheet concerned the layer of the translucency material which has a projection can perform formation of the optical diffusion layer which has detailed irregularity structure on a front face. However, the method with which a refractive-index difference with resin, such as air bubbles, such as air, and a titanium oxide particle, forms large irregularity (projection) is easy to cancel polarization and is not desirable.

[0074] As for the detailed irregularity structure of the front face in the aforementioned optical diffusion layer, what consists of irregularity which does not have periodicity at the surface roughness 100 micrometers or less above the wavelength of incident light is more desirable than points, such as the diffusibility of light, and the uniformity of the diffusion. In addition, it is more desirable than points, such as polarization maintenance nature, to control that the increment in the phase contrast by the photoelasticity or orientation arises in the base layer which consists of the resin especially on the occasion of formation of the optical diffusion layer of the above-mentioned transparence particle content mold or a surface detailed irregularity mold as much as possible.

[0075] An optical diffusion layer can also be arranged as an independent layer by a tabular object etc., and can also be arranged on a lens sheet as a subordination layer which carried out adhesion unification. When the arrangement location of an optical diffusion layer will adjoin a layered product, it is desirable to be arranged so that an opening may be generated to a layered product according to the above-mentioned lens sheet. In addition, when arranging the optical diffusion layer more than two-layer, although it differs, the thing [ holding polarization maintenance nature as a whole ] is desirable [ the optical diffusion layer may be the same, and ].

[0076] The optical element by this invention can be preferably used for formation of the plane-of-polarization light source from the property which carries out outgoing radiation of the incident light from the side as the linearly polarized light as described above from one side on the rear face of a table being shown. The plane-of-polarization light source can be formed in the at least 1 side of an optical element by arranging the light source 8, as illustrated to drawing 1 . As the light source, proper things, such as an array object of the shape of lines, such as arrangement \*\*\*\*, for example, (cold, heat), a cathode-ray tube, and light emitting diode, thru/or a field and an incandescence ball, can be used for the side of an optical element, especially its layered product 4. Above all, a cold cathode tube can use preferably from points, such as luminous efficiency, and low-power nature, narrow diameter nature. The light source can also be arranged on two or more sides, such as the 3 sides by the 2 sides in which an optical element counters from points, such as brightness and its homogeneity, \*\*\*\* of KO, etc.

[0077] In order to lead the divergence light from the light source 8 to the side of an optical element like the example of drawing if needed on the occasion of formation of the plane-of-polarization light source, an auxiliary means with the proper reflector 81 which surrounds the light source can also be arranged. Generally a resin sheet, a metallic foil, etc. which attached the metal thin film of a high reflection factor are used for a reflector. Moreover, a reflector can be installed in the underside of an optical element like the example of drawing, and the specular reflection layer 5 can also be served as and put. A reflector 51 can be arranged to 1 or two or more sides of an optical element which furthermore do not arrange the light source like the example of drawing, a light leak can be prevented, and improvement in brightness can also be aimed at. In addition, the reflector is useful also as a fixed means of the light source etc.

[0078] On the occasion of formation of the plane-of-polarization light source, two or more sorts can be arranged in one sort of a proper optical layer, or a proper location. What has the polarizing plate which especially definition does not have about the optical layer, for example, is used for formation of a liquid crystal display, a proper phase contrast board, a proper liquid crystal cell, etc. can be used. In that case, the above-mentioned lens sheet and an optical diffusion layer can also be stuck in the optical layer arranged to the optical element up side through a glue line etc. However, the arrangement which prepared the above-mentioned opening in the case of the optical diffusion layer of the lens sheet which has concavo-convex structure, or a surface detailed irregularity mold is desirable.

[0079] In addition, ultraviolet ray absorbents, such as a salicylate system compound, a benzo phenol system compound, a benzotriazol system compound, and a cyanoacrylate system compound, a nickel complex salt system compound, can be blended with each class which forms an optical element and the plane-of-polarization light source in this invention if needed, for example, ultraviolet absorption ability can be given to it.

[0080] The optical element and the plane-of-polarization light source by this invention can be used for proper equipment and the proper use which use the linearly polarized lights, such as formation of a liquid crystal display, based on the features from offering the linearly polarized light, where the plane of vibration (polarization shaft) is controlled as described above. Incidentally, a liquid crystal display can form the liquid crystal display of a back light mold by arranging a liquid crystal display panel to the optical diffusion layer 7 up side which is the optical outgoing radiation side, when it can form by incorporating the lighting system which comes to use an optical element according to the former, for example, uses the plane-of-polarization light source of instantiation as a lighting system at drawing 1 .

[0081] Moreover, in the lighting system using the optical element by this invention, the liquid crystal display which uses outdoor daylight for the illumination light, the liquid crystal display of the outdoor daylight and the mold both for lighting which uses the outdoor daylight and light source for the illumination light, etc. can be formed. In that case, in the lighting system for forming the liquid crystal display of the latter outdoor daylight and mold both for lighting, it considers as an optical element and the thing which has arranged the light source 8 on the at least 1 side of the translucency resin board 1 above all according to the plane-of-polarization light source described above as illustrated to drawing 3 . In addition, in addition to the reflector 81 which carries out envelopment immobilization of

the light source 8, in the example of drawing, the reflector 52 for light leak prevention is formed also in the side of the translucency resin board which counters the side of the light source arrangement.

[0082] The lighting system of the type which uses outdoor daylight in the above can be formed like the example of drawing 3 by forming the polarization scattered plate 3 selectively to the translucency resin board 1, and forming the portion 11 in which outdoor daylight can carry out incidence to the translucency resin board 1 efficiently. In that case, in the lighting system for liquid crystal displays, the translucency resin board 1 which has especially one 2 to 10 times the area of this is received 1.5 to 30 times above all 120% or more to a part for the display of a liquid crystal display (liquid crystal display panel) like the example of drawing. Forming selectively the specular reflection layer 5 of the polarization scattered plate 3 which has 100% of especially area 95 to 105% above all 90 to 110% and this area for said display raises the incidence effectiveness of outdoor daylight, and it is more desirable than the point of the improvement in brightness by outdoor daylight mode.

[0083] The method which arranges the liquid crystal display panel 9 on the polarization scattered plate 3 which was made to carry out a location response with the specular reflection layer 5 through the translucency resin board 1, and has been arranged can perform formation of the liquid crystal display of the outdoor daylight and the mold both for lighting using the aforementioned lighting system like drawing 3. In that case, as for the translucency resin board, polarization scattered plate, and specular reflection layer which form an optical element, it is desirable that it is in the fixed condition which carried out laminating unification for location gap prevention. When preparing housing of the liquid crystal display aiming at internal protection etc. furthermore, it is desirable that the outside of housing is made to project and outdoor daylight is made to carry out incidence of the portion 11 which does not have the polarization scattered plate of the translucency resin board 1 efficiently through the lobe.

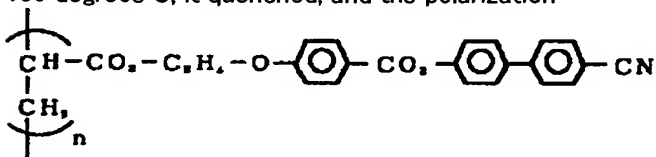
[0084] In the liquid crystal display of the above mentioned outdoor daylight and mold both for lighting The great portion of light in which excitation luminescence was carried out with the luminescent material in a translucency resin board by the illumination light by the lighting mode in the condition of having turned on the light source, and the illumination light by the outdoor daylight which carried out incidence from the lateral part for a display Since total reflection is transmitted with a repeat and outgoing radiation of the inside of the resin board is carried out as the linearly polarized light from the arrangement portion of a polarization scattered plate, the display which is more bright compared with the liquid crystal display of the usual back light system, and is excellent in visibility can be attained.

[0085] Moreover, at least the outdoor daylight mode only using excitation luminescence by the incidence of ambient lights, such as outdoor daylight, can check a liquid crystal display by looking, without using the illumination light by the light source arranged on the side of a translucency resin board. In that case, the incidence effectiveness of outdoor daylight improves, so that the area of the translucency resin board containing a luminescent material is large to a part for a display, as described above, the quantity of light of the linearly polarized light by which outgoing radiation is carried out increases more than the polarization scattered plate equivalent to a part for a display, and it is advantageous.

[0086] In order to penetrate the liquid crystal display panel which will have a liquid crystal layer, a transparent electrode layer, etc. by the time the outdoor daylight which carries out incidence from the portion by part for a display in the above reaches a translucency resin board, when the quantity of light decreases and a liquid crystal display panel has a polarizing plate etc., the quantity of light decreases more by the transparency, and lighting effectiveness is low and deficient in the contribution to the improvement in brightness. When what carries out excitation luminescence is furthermore used in ultraviolet rays as a luminescent material, almost all ultraviolet rays are absorbed, it is hard to reach a translucency resin board, and a luminescent material is hard to be excited with the ultraviolet ray absorbent contained in the protection film of a polarizing plate etc. Therefore, the method which makes the outside of housing project can apply the above-mentioned translucency resin board preferably.

[0087]

[Example] The film with a thickness of 100 micrometers be formed by the cast method using the 20-% of the weight dichloromethane solution in which the liquid crystal polymer ( glass transition temperature, nematic liquid crystallization temperature of 100-290 degrees C) 50 section express with the example 1 norbornene system resin ( product [ made from JSR ], ATON, glass transition temperature of 182 degrees C) 950 section ( it be the same the weight section and the following) and a bottom type be dissolved, after increase drawing processing of it 3 times at 180 degrees C, it quenched, and the polarization



[0088] The aforementioned polarization scattered plate was distributed in the shape of [ of the almost same configuration ] a domain in the condition [ major axis / direction / drawing / liquid crystal polymer ] in the bright film which consists of norbornene system resin, refractive-index difference  $n_1$  was 0.23, and  $n_2$  and  $n_3$  were 0.029. Moreover, when the pitch diameter of the aforementioned minute field was measured by coloring based on the phase contrast by polarization microscope observation,  $n_1$  lay length was about 5 micrometers.

[0089] Paste up so that the  $n_1$  direction may serve as a crossed axes angle of 45 degrees to an end face at one side of a commercial acrylic resin board with a thickness of 2mm through an acrylic adhesive layer in the

aforementioned polarization scattered plate, and it considers as a layered product. next, it is \*\*\*\*\* about fluorescent dye — The specular reflection sheet which gave silver vacuum evaporation has been arranged on the PET sheet on the underside, the optical element was obtained, the cold cathode tube has been arranged on the 1 side of the layered product, and the plane-of-polarization light source was acquired by fixing it as a lamp reflector using the remainder of said specular reflection sheet.

[0090] The linearly polarized light of the fluorescence color which originates in fluorescence based on the acrylic board of the fluorescent dye content in an optical element at the time of putting out lights of a cold cathode tube carries out outgoing radiation of the aforementioned plane-of-polarization light source, and its brightness improved by leaps and bounds by the observation which minded the polarizing plate compared with the commercial light guide plate which prepared the usual diffusion dot at the time of burning of a cold cathode tube.

[0091] The polarization scattered plate and the specular reflection sheet have been arranged so that only the 1/3 portion may be covered to the acrylic resin board of example 2 fluorescent-dye content, and also according to the example 1, the plane-of-polarization light source (lighting system) was formed, like the example of drawing 3, on the polarization scattered plate, the liquid crystal display panel of it and this area has been arranged, and the liquid crystal display was obtained.

[0092] The aforementioned liquid crystal display was fully able to check the content of a display by looking under the environment where the outdoor daylight is quite weak, based on the outdoor daylight which carried out incidence from the acrylic board portion which does not have a polarization scattered plate etc. at the time of putting out lights of a cold cathode tube. Moreover, the content of a display was able to be checked by looking in the very bright condition at the time of burning of a cold cathode tube.

---

[Translation done.]

\* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

TECHNICAL FIELD

---

[Field of the Invention] This invention relates to the plane-of-polarization light source and the liquid crystal display using the optical element and it to which the linearly polarized light carries out outgoing radiation of the light which carried out excitation luminescence through the incident light from the side or a table rear face where a plane of vibration is controlled from one side on the rear face of a table.

[0002]

[Background of the Invention] Conventionally, that to which the optical outgoing radiation means which becomes a translucency resin board from the reflective dot of high reflection factor pigment content of titanium oxide, a barium sulfate, etc. is formed as a side light mold light guide plate which can be used as a back light of a liquid crystal display, and it was made to carry out outgoing radiation of the transmission light by the total reflection in a board from one side of \*\*\*\*\* by dispersion etc. through the optical outgoing radiation means was known. However, most aforementioned outgoing radiation light was the natural lights which do not show a polarization property, and since there was the need of changing it into the linearly polarized light through a polarizing plate on the occasion of a liquid crystal display, they had the trouble that the absorption loss by the polarizing plate was produced and utilization effectiveness of light could not exceed 50%.

[0003] in view of the above, the system which uses together the polarization conversion means which combined the polarization division plate from which the linearly polarized light is acquired using a BURYU star angle, and the phase contrast board is proposed (JP,6-18873,A —) JP,6-160840,A, JP,6-265892,A, JP,7-72475,A, JP,7-261122,A, JP,7-270792,A, JP,9-54556,A, JP,9-105933,A, JP,9-138406,A, a JP,9-152604,A official report, JP,9-293406,A, JP,9-326205,A, JP,10-78581,A, etc. However, polarization sufficient in this back light was not acquired, but since control of the polarization direction was also difficult, the scarce difficulty was in practicability.

---

[Translation done.]

## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

## EFFECT OF THE INVENTION

---

[Effect of the Invention] According to this invention, outgoing radiation can be carried out efficiently as the linearly polarized light, and the linearly polarized light of the oscillating direction corresponding to it while it did not have a specular reflection layer on the rear face of a table for the excitation light by the outdoor daylight which carried out incidence from the natural light which did not need to form special optical outgoing radiation means, such as a reflective dot, in the translucency resin board by the above-mentioned configuration, and carried out incidence from the side, or the front reverse side can be acquired through the optical axis of the polarization scattered plate of concomitant use. Therefore, the oscillating direction of the linearly polarized light is changeable into arbitration by optical-axis control of a polarization scattered plate. Moreover, the light which the translucency resin board was made to project from a liquid crystal display, and carried out incidence to the lobe can be supplied as the linearly polarized light to a part for a display, and a display bright also at a taper can be attained.

[0007] In the above, namely, the great portion of excitation light by the incident light from the side or the front reverse side To a polarization scattered plate, total reflection being carried out by the refractive-index difference with an air interface, and transmitting the inside of a translucency resin board The inside of the incident light of incidence *Perilla frutescens* (L.) Britton var. *crispa* (Thunb.) Decne., It is scattered about strongly selectively, the part serves as an angle smaller than a total reflection angle, and the linearly polarized light which has a plane of vibration parallel to the shaft orientations (\*\*n1 direction) which show the maximum refractive-index difference (\*\*n1) with a minute field carries out outgoing radiation from an optical element. In that case, in the side which prepared the specular reflection layer, as a result of [ whole surface / of an optical element ] interrupting outgoing radiation, supplying a reverse side and concentrating outgoing radiation light on the field (front reverse side one [ which does not have a specular reflection layer ] field of an optical element), the linearly polarized light carries out outgoing radiation.

[0008] Incidentally excitation luminescence by the luminescent material in a translucency resin board is in the condition which about 80% was shut up into this resin board, and has repeated total reflection on the relation of a solid angle. Only when total reflection conditions are destroyed by dispersion by the above mentioned polarization scattered plate, in order to carry out outgoing radiation of the shut-up light from an optical element, it becomes possible to make the area portion of a polarization scattered plate, as a result its area correspond, and to centralize outgoing radiation light of it only on a part for the display of a liquid crystal display element. The light which did not receive dispersion on the other hand although it was satisfied with dispersion of the \*\*n1 aforementioned direction of the light scattered about at the large angle and the \*\*n1 direction conditions, and the light which, in addition, has the oscillating directions other than the \*\*n1 direction It is transmitted being shut up in a translucency resin board and repeating total reflection, a polarization condition is also canceled by the birefringence phase contrast by the polarization scattered plate etc., and it waits for an opportunity to satisfy and carry out outgoing radiation of the aforementioned \*\*n1 direction conditions. Outgoing radiation of the linearly polarized light of a predetermined plane of vibration is efficiently carried out by the above repeat from an optical element.

[0009]

[Embodiment of the Invention] The optical element by this invention has a specular reflection layer on one side of the layered product which comes to prepare the polarization scattered plate in which distributed content of the minute field of birefringence is carried out, and a dispersion anisotropy is shown according to the polarization direction in one side or both sides of a translucency resin board which made luminescent material contain. The example was shown in drawing 1. 1 is a translucency resin board, 3 is a polarization scattered plate, 4 is those layered products, and 5 is a specular reflection layer. In addition, 2, 6, and 7 are a glue line as occasion demands, a lens sheet, and an optical diffusion layer, respectively. In addition, drawing 1 has illustrated what was made into the plane-of-polarization light source, and 8 is the light source.

[0010] A translucency resin board should just be the tabular object formed in it using one sort of the proper material in which transparency is shown, or two sorts or more according to the wavelength region of the light source. Incidentally the board which consists of for example, acrylic resin, polycarbonate system resin, styrene resin, norbornene system resin, epoxy system resin, etc. can use preferably in a light region. The board with which a refractive index consists of small resin as much as possible is more desirable than the point of light transmittance. Moreover, rather than the point of maintaining the polarization property of outgoing radiation light, in case a small resin board has the as much as possible desirable phase contrast of field inboard and a board is fabricated rather than this point, the material which cannot produce the orientation birefringence by distortion etc. easily, especially the poly methyl meta-rate, norbornene system resin, etc. can use preferably. This resin is excellent also in the



moldability of a board.

[0011] the configuration of a translucency resin board — a liquid crystal display — according to equalization of the size of the liquid crystal cell, the property of the light source, and the brightness of outgoing radiation light etc., it can determine suitably above all, and there is especially no definition. Although a plate, a wedge-shaped board, etc. are more desirable than points, such as the ease of shaping, according to the housing configuration for [ , such as a liquid crystal display ] application etc., it can consider as a free form. When the telephone body itself incidentally consists of a translucency material like a skeleton type with a cellular phone etc., it can also consider as the structure where the body serves as a translucency resin board etc.

[0012] Although it can determine suitably according to the light source, the size of a liquid crystal cell, etc. also about the thickness of a translucency resin board and there is especially no definition, a thing thin as much as possible for the purpose of the formation of thin lightweight etc. is desirable, and 0.5–5mm is especially desirable 10mm or less above all. When aiming at furthermore improving lightning in ambient lights, such as outdoor daylight, it is desirable to consider as the translucency resin board of a larger area than the size of the screen (liquid crystal cell) of a liquid crystal display.

[0013] A method with proper for example, injection-molding method, cast-molding method, an extrusion-molding method and a flow casting shaping method, a rolling shaping method and a roll coating shaping method, transfer-molding method, reaction-injection-molding method (RIM), etc. can perform formation of a translucency resin board. A luminescent material is blended on the occasion of the formation, and proper additives, such as an antitarnish agent, an antioxidant, an ultraviolet ray absorbent, and a release agent, can be blended further if needed.

[0014] One sort of the proper material which absorbs ultraviolet rays or the light and carries out excitation luminescence of the wavelength light of a light field as the luminescent above mentioned material which a translucency resin board is made to contain, or two sorts or more can be used, and there is especially no limit. It consists of organic dye, an inorganic pigment, etc. which emit the phosphorescence which is the fluorescence and luminescence from 3-fold term which are incidentally luminescence from an one-fold excitation term as the example, for example, a fluorescence material, a light storage material, etc. by JP,3-40293,B etc. are raised.

[0015] As for a luminescent material, it is more desirable than points, such as homogeneity luminescence, to carry out homogeneity distribution as much as possible into a translucency resin board, and its thing small as much as possible than the point of control of unnecessary dispersion is [ the size of the distributed object ] desirable. In case distribution of the luminescent material to the inside of a translucency resin board forms for example, a translucency resin board, a method with the proper method which blends the luminescent material with the molding resin with other additives if needed beforehand can perform it.

[0016] The proper thing which carries out distributed content of the minute field of birefringence as a polarization scattered plate, and shows a dispersion anisotropy according to the polarization direction on the other hand can be used. Incidentally as the example, what carried out distributed content of the minute field of birefringence is raised into a bright film. A method with the proper method which uses in the combination which forms the field from which birefringence is different by the proper orientation processing by drawing processing etc. in one sort of the proper material which is excellent in transparency, such as for example, polymer and liquid crystal, or two sorts or more, and obtains an oriented film can perform the formation.

[0017] Incidentally as the aforementioned example of combination, the combination of polymer and liquid crystal, the combination of isotropic polymer and anisotropy polymer, the combination of anisotropy polymer, etc. are raised. The combination which carries out phase separation is more desirable than points, such as the distributed distribution nature of a minute field, and distributed distribution nature can be controlled by the compatibility of the material to combine. A method with proper method which solution-izes the material of for example, non-compatibility with a solvent, method which mixes the material of non-compatibility under heating melting can perform phase separation.

[0018] When carrying out orientation processing with a drawing method in the aforementioned combination, in the combination of polymer and liquid crystal, and the combination of isotropic polymer and anisotropy polymer, the target polarization scattered plate can be formed by controlling drawing conditions suitably with the combination of anisotropy polymer by arbitrary drawing temperature and draw magnification. in addition — although classified into positive/negative according to anisotropy polymer based on the property of refractive-index change of the drawing direction — this invention — setting — positive/negative — any anisotropy polymer — it can use — any of the combination of positive, negative, or positive/negative — even if — it can use.

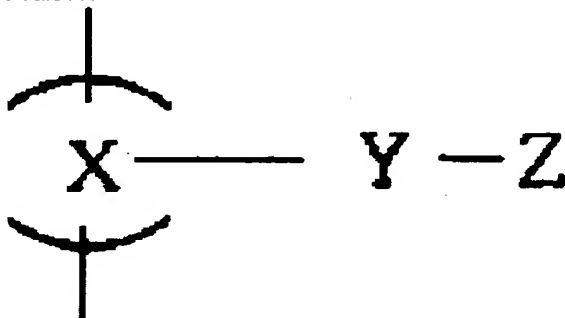
[0019] As the above mentioned example of polymer, the ester system polymer like polyethylene terephthalate or polyethylenenaphthalate, Polystyrene and the styrene system polymer like an acrylonitrile styrene copolymer (AS polymer), The olefin system polymer like polyolefine or ethylene propylene rubber which has polyethylene, polypropylene, a cyclo system, or norbornene structure, Acrylic polymer, the cellulose type polymer like diacetyl cellulose or a cellulose triacetate, and nylon and the amide system polymer like aromatic polyamide like polymethylmethacrylate are raised.

[0020] Moreover, carbonate system polymer, vinyl chloride system polymer, imide system polymer and sulfone system polymer, Polyether sulphone, a polyether ether ketone, a polyphenylene sulfide and vinyl alcohol system polymer, Vinylidene-chloride system polymer, vinyl butyral system polymer, ant rate system polymer, and polyoxymethylene, Silicone system polymer, urethane system polymer, ether system polymer and vinyl acetate system polymer, It is raised as an example of the transparence polymer which described above the polymer of heat-curing molds, such as the blend object or phenol system of said polymer, a melamine system, acrylic and an urethane system, urethane acrylic and an epoxy system, and a silicone system, thru/or an ultraviolet curing mold.

[0021] On the other hand, as an example of liquid crystal, the liquid crystal polymer which presents a nematic phase and a smectic phase is raised with the low-molecular liquid crystal which presents a nematic phase and a smectic phase at the room temperature or elevated temperature like a cyano biphenyl system, a cyanophenyl cyclohexane system, a cyanophenyl ester system and a benzoic-acid phenyl ester system, phenyl pyrimidine systems, or those mixture, a cross-linking liquid crystal monomer, a room temperature, or an elevated temperature. Usually, after the aforementioned cross-linking liquid crystal monomer carries out orientation processing, bridge formation processing is carried out by the proper method by heat, light, etc., and let it be polymer.

[0022] It is more desirable than especially the point of obtaining the polarization scattered plate which is excellent in thermal resistance, endurance, etc. that glass transition temperature uses 50 degrees C or more 80 degrees C or more above all in combination with polymer 120 degrees C or more, and a cross-linking liquid crystal monomer thru/or a liquid crystal polymer. As the liquid crystal polymer, proper things, such as a principal chain mold and a side-chain mold, can be used, and there is especially no definition about the class. The polymerization degree of especially the liquid crystal polymer that can be used more preferably than the points of excelling in the homogeneity of particle size distribution, such as the plasticity of a minute field, thermal stability, a moldability to a film, and the ease of orientation processing, is the thing of 15-5000 ten or more above all eight or more.

[0023] One sort of the liquid crystal polymer for forming one sort or two sorts or more, and minute field of for example, polymer or two sorts or more can be mixed, the polymer film which carries out distributed content of the liquid crystal polymer in the state of a minute field can be formed, orientation processing can be carried out by the proper method, and formation of the polarization scattered plate using a liquid crystal polymer can be performed by the method of forming the field from which birefringence is different etc. What glass transition temperature is 50 degrees C or more, and presents a nematic liquid crystal phase in a temperature region lower than the glass transition temperature of the polymer of concomitant use rather than points, such as the controllability of the above-mentioned refractive-index difference  $n_1$  by orientation processing and  $n_2$ , can use preferably. The liquid crystal polymer of a side-chain mold which has the monomeric unit incidentally expressed with the following general formula as the example is raised.

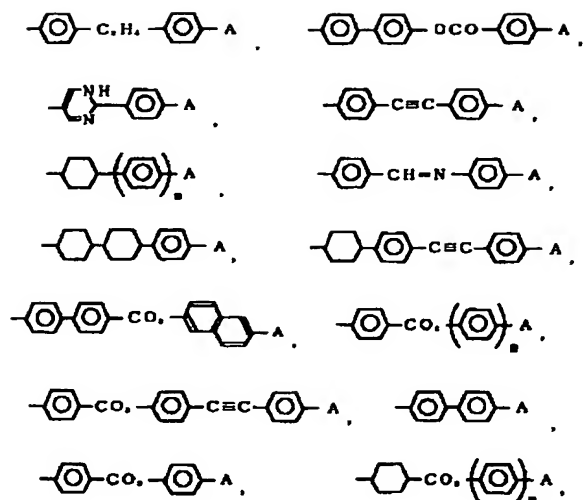


[0024] General formula :

[0025] In the aforementioned general formula, X is a frame radical which forms the principal chain of a liquid crystal polymer, and may be formed in proper joining chains, such as a line, a letter of branching, and annular. Incidentally as the example, polyacrylates, polymethacrylates, Poly alpha-halo acrylate and Poly alpha-cyanoacrylate, polyacrylamides and polyacrylonitriles, the poly methacrylonitriles and polyamides, polyester and polyurethane, polyethers, polyimide and polysiloxanes, etc. are raised.

[0026] Moreover, Y is a spacer radical which branches from a principal chain, and the spacer radicals Y more desirable than points, such as the plasticity of polarization scattered plates, such as refractive-index control, are ethylene, a propylene and a butylene, pentene, hexylene and octylene, decylene and undecylene, dodecylene and OKUTA decylene, ethoxyethylene, a methoxy butylene, etc.

[0027] On the other hand, Z is a meso gene radical which gives a liquid crystal stacking tendency, and the following compound etc. is raised.



[0028] The halo alkyl group and haloalkoxy radical by which one or more of a cyano group, an alkyl group, an alkenyl radical, an alkoxy group, an OKISA alkyl group, or hydrogen were replaced with a fluorine or chlorine, the halo alkenyl radical of the end substituent A in said compound, etc. may be proper.

[0029] In the above, the spacer radical Y and the meso gene radical Z may be combined through ether linkage, i.e., -O-. Moreover, its one piece or two hydrogen may be replaced by the halogen, and the phenyl group in the meso gene radical Z has chlorine or a desirable fluorine as a halogen in that case.

[0030] As for the side-chain mold liquid crystal polymer of the above-mentioned nematic stacking tendency, what is excellent in a mono-domain stacking tendency above all is [ that what is necessary is just proper thermoplastic polymer, such as a homopolymer a copolymer, etc. which have the monomeric unit expressed with the aforementioned general formula, ] desirable.

[0031] Formation of the polarization scattered plate using the liquid crystal polymer of a nematic stacking tendency. The glass transition temperature which presents a nematic liquid crystal phase in a temperature region lower than the glass transition temperature of the polymer and polymer for forming a polymer film For example, 50 degrees C or more, After forming above all 60 degrees C or more of polymer films which mix especially a liquid crystal polymer 70 degrees C or more, and carry out distributed content of the liquid crystal polymer in the state of a minute field, The liquid crystal polymer which forms the minute field can be heat-treated, orientation can be carried out to a nematic liquid crystal phase, and the orientation condition can be performed by the method of carrying out cooling immobilization etc.

[0032] Formation of the polymer film which carries out distributed content of the above-mentioned minute field, i.e., the film of an orientation processing object, can be obtained by proper methods, such as for example, the casting method, an extrusion method, an injection-molding method, and roll diffusion bonding, the flow casting fabricating method, and the method which develops in the state of a monomer, carries out the polymerization of it by radiation treatment, such as heat-treatment and ultraviolet rays, etc., and produces a film in the shape of a film can perform it.

[0033] The method which produces the mixed liquor of the formation material through a solvent by the casting method, the flow casting fabricating method, etc. is more desirable than the point of obtaining the polarization scattered plate which is excellent in the equal distribution nature of a minute field etc. In that case, minute area size, distribution nature, etc. are controllable by the class of solvent, the viscosity of mixed liquor, the rate of drying of a mixed liquor expansion layer, etc. Incidentally hypoviscosity-izing of mixed liquor, acceleration of the rate of drying of a mixed liquor expansion layer, etc. are advantageous to the formation of small area of a minute field.

[0034] Although the thickness of the film of an orientation processing object can be determined suitably, especially generally it is set to 10-500 micrometers 5 micrometers - 1mm above all 1 micrometer - 3mm from points, such as orientation processability. In addition, on the occasion of formation of a film, proper additives, such as a dispersant, a surfactant, an ultraviolet ray absorbent, a color tone modifier, a flame retarder, and a release agent, an antioxidant, can be blended, for example.

[0035] As described above, orientation processing For example, one shaft, biaxial, drawing mode of processing and a rolling method according to biaxial, the Z-axis, etc. serially, The method which impresses and quenches electric field or a magnetic field at the temperature more than glass transition temperature or liquid crystal transition temperature, and fixes orientation, and the method which carries out floating orientation at the time of film production, It can carry out using one sort of the proper method which can control a refractive index by orientation, such as a method to which self-orientation of the liquid crystal is carried out based on the slight orientation of isotropic polymer, or two sorts or more. Therefore, the obtained polarization scattered plate may be an oriented film, and may be a non-oriented film. In addition, although brittle polymer can also be used when considering as an oriented film, the polymer which is excellent in stretch nature can use preferably especially.

[0036] Moreover, melting can be heated and carried out to the temperature which presents the liquid crystal phase which the liquid crystal polymer which carries out distributed distribution as a minute field makes the object of

nematic equality for example, into a polymer film in consisting of a liquid crystal polymer which the minute field described above, orientation of it can be carried out to the bottom of an operation of orientation restraining force, it can quench, and the method which fixes an orientation condition can perform. As for the orientation condition of a minute field, it is more desirable than points, such as variation prevention of an optical property, that it is in a mono-domain condition as much as possible.

[0037] In addition, the proper restraining force which is made to carry out orientation of the liquid crystal polymers, such as drawing force by the method which carries out drawing processing of the polymer film, for example for a proper scale factor, share ring force at the time of film formation, electric field, and a magnetic field, and deals in them as the aforementioned orientation restraining force can be applied, one sort or two sorts or more of the restraining force can be made to be able to act, and orientation processing of a liquid crystal polymer can be performed.

[0038] Therefore, portions other than the minute field in a polarization scattered plate may show birefringence, and may be isotropic things. That the whole polarization scattered plate indicates birefringence to be can be obtained by the molecular orientation in the film production process which used and described the thing of orientation birefringence above to the polymer for film formation etc., can add well-known orientation means, such as drawing processing, if needed, for example, can give thru/or control birefringence. Moreover, portions other than a minute field can obtain an isotropic polarization scattered plate using an isotropic thing with the method which carries out drawing processing of the film in the temperature field below the glass transition temperature of the polymer concerned to the polymer for for example, film formation.

[0039] The portion with the as other polarization scattered plate which can be used preferably as a minute field, i.e., the portion which it becomes from a polymer film Refractive-index difference  $\Delta n_1$  in each optical-axis direction of a minute field,  $\Delta n_2$ , and  $\Delta n_3$  are 0.03 ( $\Delta n_1$ ) or more in the shaft orientations ( $\Delta n_1$  direction) which show maximum. And it controls to become 50% or less ( $\Delta n_2$ ,  $\Delta n_3$ ) of the aforementioned  $\Delta n_1$  in the biaxial direction ( $\Delta n_2$ -way,  $\Delta n_3$  direction) which intersects perpendicularly with the  $\Delta n_1$  direction and which remains, and the equal of  $\Delta n_2$  and  $\Delta n_3$  is more desirable.

[0040] By considering as the aforementioned refractive-index difference, the quantity of light which the linearly polarized lights of  $\Delta n_1$  direction are scattered about strongly, are scattered about at an angle smaller than a total reflection angle, and carries out outgoing radiation from an optical element can be increased, and the linearly polarized lights of the other direction cannot be scattered about easily, and can shut up total reflection in a repeat and an optical element.

[0041] In the above in addition, the refractive-index difference of each optical-axis direction of a minute field, and portions other than a minute field When the polymer which forms a film is the thing of the optical isotropy When the polymer which means the difference of the refractive index of each optical-axis direction of a minute field and the average refractive index of a polymer film, and forms a film is the thing of optical anisotropy Since the direction of the main optical axis of a polymer film and the direction of the main optical axis of a minute field are usually in agreement, the difference of each refractive index in each shaft orientations is meant.

[0042] The moderately large thing of refractive-index difference  $\Delta n_1$  in  $\Delta n_1$  direction is desirable, and it is more desirable than the point of the above mentioned total reflection 0.035-1, and that it is especially refractive-index difference  $\Delta n_1$  of 0.045-0.5 above all. The moderately small thing of refractive-index difference  $\Delta n_2$  in  $\Delta n_2$ -way and  $\Delta n_3$  direction and  $\Delta n_3$  is desirable. This refractive-index difference is controllable by the refractive index of the material of construction, the above-mentioned orientation actuation, etc.

[0043] Moreover, as for this  $\Delta n_1$  direction, it is more desirable than the  $\Delta n_1$  aforementioned direction is the plane of vibration of the linearly polarized light by which outgoing radiation is carried out from an optical element that it is parallel to a polarization scattered plate side. In addition, this  $\Delta n_1$  direction of [ within a field ] can be made into the proper direction according to the liquid crystal display made into the object.

[0044] As for the minute field in a polarization scattered plate, it is more desirable than points [ , such as homogeneity, ], such as said scattering effect, to carry out distributed distribution uniformly as much as possible. The  $\Delta n_1$  lay length which is minute area size, especially the dispersion direction is related to a backscattering (echo) or a wavelength dependency.

[0045] Improvement in efficiency for light utilization, prevention of coloring by the wavelength dependency, prevention of the check-by-looking inhibition by the vision of a minute field or clear inhibition prevention of a display, magnitude with a minute field still more desirable than points, such as film production nature and film reinforcement, and the 0.05-500 micrometers especially of the 0.1-250 micrometers especially of the desirable length of  $\Delta n_1$  direction are 1-100 micrometers above all. In addition, although a minute field exists in a polarization scattered plate in the state of a domain usually, there is especially no definition about lengths, such as the  $\Delta n_2$ -way.

[0046] Although the rate of the minute field occupied in a polarization scattered plate can be determined more suitably than points, such as the dispersion nature of  $\Delta n_1$  direction, generally it is based on film reinforcement etc. and is especially made into 1 - 30 % of the weight 0.5 to 50% of the weight above all 0.1 to 70% of the weight.

[0047] A polarization scattered plate can also be formed in the monolayer of the film in which the above-mentioned birefringence property is shown, and can also be formed as what superimposed this film more than two-layer. By superposition-ization of the film concerned, the multiplication-scattering effect beyond the increment in thickness can be demonstrated. Although a superposition object may superimpose the film concerned at arbitrary arrangement angles, such as  $\Delta n_1$  direction or  $\Delta n_2$ -way, what was superimposed so that  $\Delta n_1$  direction might serve as parallel

relation from points, such as amplification of a scattering effect, in an up-and-down layer is desirable. The number of superposition of the film concerned can be made into the proper number more than two-layer.

[0048] The film concerned to superimpose may have  $n_1$  or the same  $n_2$  grade, and may differ. In addition, although the as much as possible parallel thing of the parallel relation in the layer of the upper and lower sides in  $n_1$  direction etc. is desirable, the gap by the activity error etc. is permitted. Moreover, when there is variation in the  $n_1$  direction etc., it is based in the average direction.

[0049] The film concerned in a superposition object is pasted up through a glue line etc. so that a total reflection interface may turn into the maximum front face. Proper adhesives, such as for example, a hot melt system and an adhesion system, can be used for the adhesion. Rather than the point which controls reflection loss, as much as possible, the small glue line of a refractive-index difference with the film concerned is desirable, and it can also paste up in the polymer which forms a film and its minute field concerned.

[0050] In addition, a polarization scattered plate has the thing [ board / whole ] more desirable than a polarization condition needs to be suitably canceled in the process in which light transmits the inside of an optical element for which it is or has phase contrast selectively. Although the polarization conversion by phase contrast cannot break out easily since the lagging axis of a polarization scattered plate and the polarization shaft (plane of vibration) of the linearly polarized light which cannot be scattered about easily are in orthogonality relation fundamentally, an apparent angle changes with slight dispersion and it is thought that polarization conversion arises.

[0051] Although it is more desirable than the point of the above mentioned polarization conversion that there is generally phase contrast within a field 5nm or more, the value changes with the thickness of a polarization scattered plate. In addition, a method with proper method which makes the particle of birefringence contain, method made to adhere to a front face, method which makes a polymer film birefringence, method which uses them together can perform grant of the phase contrast.

[0052] Although the layered product of the translucency resin board of luminescent material content and a polarization scattered plate is used for the optical element by this invention As illustrated to drawing 1 on the occasion of the formation, in order to control the echo by the interface of the translucency resin board 1 and the polarization scattered plate 3 as much as possible, That is, in order to attain the total reflection on the rear face of a table of a layered product which makes easy transparency of the transmission light between a translucency resin board and a polarization scattered plate, and really [ those / adhesion ] consists of an object, it is desirable to have pasted up with adhesives with a near refractive index etc. as much as possible. Adhesion processing is more effective than points, such as gap prevention of axial relation. In addition, on the occasion of formation of an optical element, as illustrated to drawing 2, the polarization scattered plate 3 can also be formed in front reverse side both sides of the translucency resin board 1.

[0053] The aforementioned adhesion processing can use proper adhesives, such as transparent binders, such as acrylic, a silicone system, a polyester system and a polyurethane system, a polyether system, and a rubber system, according to the polarization scattered plate of the above-mentioned superposition mold, and there is especially no definition. What neither hardening nor desiccation takes  $\Delta T$ , and hardening and desiccation processing of long duration for an elevated-temperature process is more desirable than the point of preventing change of an optical property etc. Moreover, what does not produce exfoliation problems, such as a float and peeling, under the condition of heating or humidification is desirable.

[0054] The acrylic binder with which the weight average molecular weight which comes to copolymerize the acrylic monomer which carbon numbers, such as a methyl group, an ethyl group, and butyl, become from amelioration components, such as alkyl ester of the acrylic acid which has 20 or less alkyl group (meta), and an acrylic acid (meta), acrylic-acid (meta) hydroxyethyl, from the aforementioned point in the combination from which glass transition temperature becomes 0 degree C or less makes 100,000 or more acrylic polymers base polymer is used preferably. The acrylic binder also has the advantage which is excellent in transparency, weatherability, thermal resistance, etc.

[0055] A proper method can perform the attachment of the adhesive layer to a translucency resin board or/and a polarization scattered plate. Make the solvent which consists of the independent object or mixture of a proper solvent, such as toluene and ethyl acetate, as the example dissolve or distribute a binder component, and about 10 - 40% of the weight of binder liquid is prepared. The method which attaches it directly on a translucency resin board or a polarization scattered plate by proper expansion methods, such as a flow casting method and a coating method, or the method which forms an adhesive layer on a separator according to the above, and carries out transfer of it on a translucency resin board or a polarization scattered plate is held. The adhesive layer to prepare may be a superposition layer of things, such as a different presentation or a class.

[0056] The thickness of a glue line can be suitably determined according to adhesive strength etc., and, generally is set to 1-500 micrometers. Proper additives, such as a bulking agent which consists of the resin of a natural product or a compost, a glass fiber, a glass bead and a metal powder, other inorganic powder, etc. if needed, a pigment and a coloring agent, and an antioxidant, can also be blended with a glue line.

[0057] The specular reflection layer 5 prepared in one side of the layered product 4 of the translucency resin board 1 and the polarization scattered plate 3 like instantiation at drawing 1 aims at reversing the light which carries out outgoing radiation from the reflecting layer arrangement side, without changing a polarization condition through a specular reflection layer, centralizing outgoing radiation light on one side on the rear face of a table of an optical element, and raising brightness.

[0058] As the aforementioned reflecting layer, it is desirable that it is a mirror plane as much as possible than the

point of maintenance of a polarization condition, and the reflector which consists of a metal or a dielectric multilayer from this point is desirable. As the metal, proper things, such as aluminum, silver, chromium metallurgy, copper and tin, zinc, an indium and palladium, and platinum or its alloy, can be used.

[0059] Although a specular reflection layer can also be directly stuck to a layered product as an attachment layer of the metal thin film by a vacuum evaporation method etc., a full echo is difficult, and the arrangement method with which only the air space which only piles up a reflecting plate and places it may intervene is more desirable than the point of we being anxious about absorption loss if some absorption by the reflecting layer arises too and the repeat by total reflection is taken into consideration, and preventing it.

[0060] Therefore, tabular things, such as a reflecting plate which attached the metal thin film to for example, the support base material by the sputtering method, the vacuum evaporation method, etc., and a rolling sheet of a metallic foil metallurgy group, can use a specular reflection layer preferably from this point. Proper things, such as a glass plate and a resin sheet, can be used for the above-mentioned support base material of a reflecting layer. Above all, what was vapor-deposited on the resin sheet can use silver, aluminum, etc. preferably from points, such as a reflection factor, and a tint, handling nature. Moreover, about the specular reflection layer which consists of a dielectric multilayer, it can apply to a well-known example (for example, \*\*\*\*\* No. 511322 [ ten to ] official report) etc. correspondingly. In addition, a reflecting layer may be arranged to any of the front reverse side of a layered product.

[0061] On the other hand, in the field which does not arrange, the reverse side, i.e., aforementioned specular reflection layer, of a layered product, proper optical layers, such as the lens sheet 6 of polarization maintenance nature and the optical diffusion board 7, can also be arranged like the example of drawing 1 if needed. This lens sheet carries out optical-path control of the outgoing radiation light (linearly polarized light) of the dispersion nature from a layered product, maintaining the degree of polarization as much as possible, raises the directivity to the direction of a transverse plane advantageous to a check by looking, and aims at making the outgoing radiation luminous-intensity peak of dispersion nature into the direction of a transverse plane etc.

[0062] The proper thing which carries out optical-path control and was [ a sheet side ] made to carry out outgoing radiation of the scattered light which carried out incidence from one side (rear face) as a lens sheet efficiently in the vertical (transverse plane) direction as much as possible on the other hand (front face) can be used, and there is especially no definition. Therefore, anything that has various kinds of lens gestalten of an activity with the conventional side light mold light guide plate except for the point of polarization maintenance nature can be used (for example, JP,5-169015,A etc.). It excels in whenever [ light transmission ] so that according [ the lens sheet used preferably ] to depolarization for example when all [ 90% or more of ] light transmission is shown especially 85% or more above all 80% or more and it has arranged between crossing Nicol's prisms leakage light (permeability) may be especially 1% or less 2% or less above all 5% or less, and the polarization property of outgoing radiation light is not canceled as much as possible.

[0063] From generally the dissolution of polarization arising by the birefringence or multiple scattering, for example, the lens sheet in which the above mentioned polarization maintenance nature is shown It can attain reducing a birefringence as much as possible, by reducing the count of an average echo (dispersion) in the locus of a beam of light, etc. The inside of polymer \*\* illustrated with the translucency resin board specifically described above or the polarization scattered plate, The low resin (good resin of the optical isotropy) of the birefringence like cellulose-triacetate system resin, a polymethyl methacrylate and a polycarbonate, or norbornene system resin can be obtained with one sort or the method which uses two or more sorts and forms a lens sheet.

[0064] The lens field of a convex lens mold or a refractive-index distribution pattern (GI mold) which comes to control a refractive index the front face or inside a transparent resin base material through a photopolymerization object etc. as a lens sheet as mentioned above, [ which may contain the resin from which a refractive index is different, for example ] What formed many minute lens fields especially, and the thing which filled up with the polymer of a refractive-index difference the breakthrough of a large number prepared in the transparent resin base material, and formed the lens field, Or although it has proper lens gestalten, such as what carried out monolayer arrangement of many spherical lenses, and fixed it with the thin film What has the lens gestalt 61 which becomes drawing 1 from concavo-convex structure like instantiation at one side of a sheet 6 or both sides, especially one side is more desirable than the point of the optical-path control through a difference of a refractive index etc.

[0065] That the concavo-convex structure which forms the aforementioned lens gestalt should just be what demonstrates the function which controls the optical path of the light which penetrated the sheet and condenses the transmitted light in the direction of a transverse plane For example, what the minute cone-like projection which has base configurations, such as a thing which linear slots, such as a cross-section triangle, and a projection arranged the shape of a stripe and in the shape of a grid or a triangular pyramid and a rectangular-head drill, other multiple drills, and a cone, arranged to punctiform is raised. In addition, the concavo-convex structures of linear or punctiform may be a spherical lens, an aspheric lens, a semicircle cylinder lens, etc., and may have a proper lens gestalt.

[0066] A method with the proper method which carries out heating sticking by pressure of the resin sheet at the method which fills up with resin liquid or the monomer for resin formation the mold formed so that concavo-convex predetermined structure might be formed, carries out polymerization if needed, and imprints the type concerned of concavo-convex structure, or the mold concerned, and imprints the concavo-convex structure can perform formation of the lens sheet which has the above mentioned concavo-convex structure of linear or punctiform. In addition, the lens sheet may be formed as a superposition layer more than the bilayer [ like ] of a resin layer of the



same kind or of a different kind etc., although the lens gestalt was added to the support sheet.

[0067] A lens sheet can be arranged one layer or more than two-layer to the optical outgoing radiation side of a layered product. When arranging more than two-layer, the lens sheet may be the same, and although it differs, the thing [ holding polarization maintenance nature as a whole ] is desirable. When the lens sheet to arrange will adjoin a layered product, it is desirable to be arranged so that an opening may be generated to a layered product like the case of the above-mentioned specular reflection layer. Moreover, the thing large more fully than the wavelength of incident light of the opening is more desirable than the point of total reflection.

[0068] In addition, when the lens gestalt in a lens sheet consists of linear concavo-convex structure, it is desirable to arrange so that the direction of a line may be in the direction of an optical axis of a polarization scattered plate (the direction of a plane of vibration of outgoing radiation polarization), a parallel condition, or a rectangular condition from points, such as optical-path control to the direction of a transverse plane. Moreover, when arranging this lens sheet more than two-layer, it is more desirable than the point of the effectiveness of optical-path control to arrange so that the direction of a line may cross in an up-and-down layer.

[0069] An optical diffusion board aims at diffusing outgoing radiation light (linearly polarized light), maintaining the degree of polarization as much as possible, equalizing luminescence, or easing the vision of the pattern of a lens sheet, and raising visibility etc. An optical diffusion board can be replaced with a lens sheet, or can arrange one layer or more than two-layer in proper locations, such as between a lens sheet and a layered product or an optical outgoing radiation side of a lens sheet.

[0070] As an optical diffusion layer, it excels in whenever [ light transmission ] according to the above-mentioned lens sheet, and what maintains the polarization property of outgoing radiation light as much as possible is used preferably. Therefore, the optical diffusion layer of this polarization maintenance nature can be acquired as what resin with the small rate of a birefringence illustrated with the above-mentioned lens sheet is preferably used for formation of an optical diffusion layer, for example, carries out distributed content of the transparence particle into the resin layer, a resin layer which has detailed irregularity structure on a front face.

[0071] in addition, as a transparence particle which carries out distributed content, in the aforementioned resin layer For example, a silica thru/or glass and an alumina, a titania and a zirconia, tin oxide, and indium oxide, The conductive thing which consists of cadmium oxide, antimony oxide, etc. A certain inorganic system particle, Or acrylic polymer, a polyacrylonitrile, polyester and epoxy system resin, Melamine system resin, urethane system resin, a polycarbonate and polystyrene, The organic system particle which consists of polymer for which a bridge is not constructed [ the bridge formation like silicone system resin, benzoguanamine and a melamine benzoguanamine condensate, or a benzoguanamine formaldehyde condensate or ] is raised.

[0072] One sort or two sorts or more can be used for a transparence particle, and 1-20 micrometers of particle size are more desirable than points, such as the diffusibility of light, and the uniformity of the diffusion. On the other hand, although the grain shape is arbitrary, generally a globular form (truth), its secondary floc, etc. are used. Especially rather than the point of polarization maintenance nature, the transparence particle of 0.9-1.1 can use [ a refractive-index ratio with resin ] preferably. The optical diffusion layer of particle content can be formed by the proper method according to the former, such as a method which mixes a transparence particle in the melting liquid of resin, and carries out extrusion molding to a sheet etc., a method which blends a transparence particle with the solution and the monomer of resin, casts for a sheet etc., and carries out polymerization if needed, and a method which carries out coating of the resin liquid of transparence particle content to a predetermined side, the support film of polarization maintenance nature, etc.

[0073] On the other hand, a method with proper method which split-face-izes the front face of the sheet which consists of resin with buff processing, an embossing method, etc. by sandblasting etc., method which forms in the front face of the sheet concerned the layer of the translucency material which has a projection can perform formation of the optical diffusion layer which has detailed irregularity structure on a front face. However, the method with which a refractive-index difference with resin, such as air bubbles, such as air, and a titanium oxide particle, forms large irregularity (projection) is easy to cancel polarization and is not desirable.

[0074] As for the detailed irregularity structure of the front face in the aforementioned optical diffusion layer, what consists of irregularity which does not have periodicity at the surface roughness 100 micrometers or less above the wavelength of incident light is more desirable than points, such as the diffusibility of light, and the uniformity of the diffusion. In addition, it is more desirable than points, such as polarization maintenance nature, to control that the increment in the phase contrast by the photoelasticity or orientation arises in the base layer which consists of the resin especially on the occasion of formation of the optical diffusion layer of the above-mentioned transparence particle content mold or a surface detailed irregularity mold as much as possible.

[0075] An optical diffusion layer can also be arranged as an independent layer by a tabular object etc., and can also be arranged on a lens sheet as a subordination layer which carried out adhesion unification. When the arrangement location of an optical diffusion layer will adjoin a layered product, it is desirable to be arranged so that an opening may be generated to a layered product according to the above-mentioned lens sheet. In addition, when arranging the optical diffusion layer more than two-layer, although it differs, the thing [ holding polarization maintenance nature as a whole ] is desirable [ the optical diffusion layer may be the same, and ].

[0076] The optical element by this invention can be preferably used for formation of the plane-of-polarization light source from the property which carries out outgoing radiation of the incident light from the side as the linearly polarized light as described above from one side on the rear face of a table being shown. The plane-of-polarization light source can be formed in the at least 1 side of an optical element by arranging the light source 8, as illustrated



to drawing 1 . As the light source, proper things, such as an array object of the shape of lines, such as arrangement \*\*\*\*, for example, (cold, heat), a cathode-ray tube, and light emitting diode, thru/or a field and an incandescence ball, can be used for the side of an optical element, especially its layered product 4. Above all, a cold cathode tube can use preferably from points, such as luminous efficiency, and low-power nature, narrow diameter nature. The light source can also be arranged on two or more sides, such as the 3 sides by the 2 sides in which an optical element counters from points, such as brightness and its homogeneity, \*\*\*\* of KO, etc.

[0077] In order to lead the divergence light from the light source 8 to the side of an optical element like the example of drawing if needed on the occasion of formation of the plane-of-polarization light source, an auxiliary means with the proper reflector 81 which surrounds the light source can also be arranged. Generally a resin sheet, a metallic foil, etc. which attached the metal thin film of a high reflection factor are used for a reflector. Moreover, a reflector can be installed in the underside of an optical element like the example of drawing, and the specular reflection layer 5 can also be served as and put. A reflector 51 can be arranged to 1 or two or more sides of an optical element which furthermore do not arrange the light source like the example of drawing, a light leak can be prevented, and improvement in brightness can also be aimed at. In addition, the reflector is useful also as a fixed means of the light source etc.

[0078] On the occasion of formation of the plane-of-polarization light source, two or more sorts can be arranged in one sort of a proper optical layer, or a proper location. What has the polarizing plate which especially definition does not have about the optical layer, for example, is used for formation of a liquid crystal display, a proper phase contrast board, a proper liquid crystal cell, etc. can be used. In that case, the above-mentioned lens sheet and an optical diffusion layer can also be stuck in the optical layer arranged to the optical element up side through a glue line etc. However, the arrangement which prepared the above-mentioned opening in the case of the optical diffusion layer of the lens sheet which has concavo-convex structure, or a surface detailed irregularity mold is desirable.

[0079] In addition, ultraviolet ray absorbents, such as a salicylate system compound, a benzo phenol system compound, a benzotriazol system compound, and a cyanoacrylate system compound, a nickel complex salt system compound, can be blended with each class which forms an optical element and the plane-of-polarization light source in this invention if needed, for example, ultraviolet absorption ability can be given to it.

[0080] The optical element and the plane-of-polarization light source by this invention can be used for proper equipment and the proper use which use the linearly polarized lights, such as formation of a liquid crystal display, based on the features from offering the linearly polarized light, where the plane of vibration (polarization shaft) is controlled as described above. Incidentally, a liquid crystal display can form the liquid crystal display of a back light mold by arranging a liquid crystal display panel to the optical diffusion layer 7 up side which is the optical outgoing radiation side, when it can form by incorporating the lighting system which comes to use an optical element according to the former, for example, uses the plane-of-polarization light source of instantiation as a lighting system at drawing 1 .

[0081] Moreover, in the lighting system using the optical element by this invention, the liquid crystal display which uses outdoor daylight for the illumination light, the liquid crystal display of the outdoor daylight and the mold both for lighting which uses the outdoor daylight and light source for the illumination light, etc. can be formed. In that case, in the lighting system for forming the liquid crystal display of the latter outdoor daylight and mold both for lighting, it considers as an optical element and the thing which has arranged the light source 8 on the at least 1 side of the translucency resin board 1 above all according to the plane-of-polarization light source described above as illustrated to drawing 3 . In addition, in addition to the reflector 81 which carries out envelopment immobilization of the light source 8, in the example of drawing, the reflector 52 for light leak prevention is formed also in the side of the translucency resin board which counters the side of the light source arrangement.

[0082] The lighting system of the type which uses outdoor daylight in the above can be formed like the example of drawing 3 by forming the polarization scattered plate 3 selectively to the translucency resin board 1, and forming the portion 11 in which outdoor daylight can carry out incidence to the translucency resin board 1 efficiently. In that case, in the lighting system for liquid crystal displays, the translucency resin board 1 which has especially one 2 to 10 times the area of this is received 1.5 to 30 times above all 120% or more to a part for the display of a liquid crystal display (liquid crystal display panel) like the example of drawing. Forming selectively the specular reflection layer 5 of the polarization scattered plate 3 which has 100% of especially area 95 to 105% above all 90 to 110% and this area for said display raises the incidence effectiveness of outdoor daylight, and it is more desirable than the point of the improvement in brightness by outdoor daylight mode.

[0083] The method which arranges the liquid crystal display panel 9 on the polarization scattered plate 3 which was made to carry out a location response with the specular reflection layer 5 through the translucency resin board 1, and has been arranged can perform formation of the liquid crystal display of the outdoor daylight and the mold both for lighting using the aforementioned lighting system like drawing 3 . In that case, as for the translucency resin board, polarization scattered plate, and specular reflection layer which form an optical element, it is desirable that it is in the fixed condition which carried out laminating unification for location gap prevention. When preparing housing of the liquid crystal display aiming at internal protection etc. furthermore, it is desirable that the outside of housing is made to project and outdoor daylight is made to carry out incidence of the portion 11 which does not have the polarization scattered plate of the translucency resin board 1 efficiently through the lobe.

[0084] In the liquid crystal display of the above mentioned outdoor daylight and mold both for lighting The great portion of light in which excitation luminescence was carried out with the luminescent material in a translucency resin board by the illumination light by the lighting mode in the condition of having turned on the light source, and

the illumination light by the outdoor daylight which carried out incidence from the lateral part for a display Since total reflection is transmitted with a repeat and outgoing radiation of the inside of the resin board is carried out as the linearly polarized light from the arrangement portion of a polarization scattered plate, the display which is more bright compared with the liquid crystal display of the usual back light system, and is excellent in visibility can be attained.

[0085] Moreover, at least the outdoor daylight mode only using excitation luminescence by the incidence of ambient lights, such as outdoor daylight, can check a liquid crystal display by looking, without using the illumination light by the light source arranged on the side of a translucency resin board. In that case, the incidence effectiveness of outdoor daylight improves, so that the area of the translucency resin board containing a luminescent material is large to a part for a display, as described above, the quantity of light of the linearly polarized light by which outgoing radiation is carried out increases more than the polarization scattered plate equivalent to a part for a display, and it is advantageous.

[0086] In order to penetrate the liquid crystal display panel which will have a liquid crystal layer, a transparent electrode layer, etc. by the time the outdoor daylight which carries out incidence from the portion by part for a display in the above reaches a translucency resin board, when the quantity of light decreases and a liquid crystal display panel has a polarizing plate etc., the quantity of light decreases more by the transparency, and lighting effectiveness is low and deficient in the contribution to the improvement in brightness. When what carries out excitation luminescence is furthermore used in ultraviolet rays as a luminescent material, almost all ultraviolet rays are absorbed, it is hard to reach a translucency resin board, and a luminescent material is hard to be excited with the ultraviolet ray absorbent contained in the protection film of a polarizing plate etc. Therefore, the method which makes the outside of housing project can apply the above-mentioned translucency resin board preferably.

---

[Translation done.]

**\* NOTICES \***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

**TECHNICAL PROBLEM**

---

[The technical technical problem of invention] The outgoing radiation light which consists of the linearly polarized light is obtained, and this invention can also control the polarization direction (plane of vibration) to arbitration, and makes a technical problem development of the optical element which can also use utilization of outdoor daylight as a possible light guide plate etc.

---

[Translation done.]

**\* NOTICES \***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

**MEANS**

---

[Means for Solving the Problem] This invention to one side or both sides of a translucency resin board which made a luminescent material contain An optical element characterized by having a specular reflection layer on one side of a layered product which comes to prepare a polarization scattered plate in which distributed content of the minute field of birefringence is carried out, and a dispersion anisotropy is shown according to the polarization direction, And the plane-of-polarization light source characterized by coming to arrange the light source on the at least 1 side of the optical element and a liquid crystal display characterized by providing a lighting system which comes to use the aforementioned optical element for a list are offered.

---

[Translation done.]

JAPANESE [JP,2002-243938,A]

---

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD EFFECT OF THE INVENTION TECHNICAL PROBLEM  
MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

---

[Translation done.]

\* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

DESCRIPTION OF DRAWINGS

---

[Brief Description of the Drawings]

[Drawing 1] The cross section of the example of the plane-of-polarization light source

[Drawing 2] The cross section of other examples of an optical element

[Drawing 3] The perspective diagram of the example of a liquid crystal display

[Description of Notations]

4: Layered product

1: Translucency resin board 2: Glue line 3: Polarization scattered plate

5: Specular reflection layer

8: Light source

9: Liquid crystal display panel

---

[Translation done.]

## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

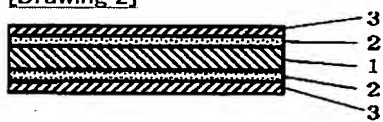
- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

## DRAWINGS

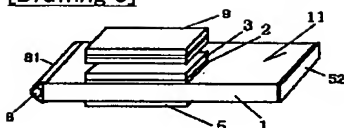
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]



(19)日本国特許庁 (J P)

(12) 公 開 特 許 公 報 (A)

(11)特許出願公開番号

特開2002-243938

(P2002-243938A)

(43)公開日 平成14年8月28日(2002.8.28)

(51)Int.Cl. <sup>7</sup>	識別記号	F I	テ-マ-ト*(参考)
G 0 2 B 5/30		G 0 2 B 5/30	2 H 0 4 2
C 0 8 L 101/00		C 0 8 L 101/00	2 H 0 4 9
G 0 2 B 5/02		G 0 2 B 5/02	B 2 H 0 9 1
5/08		5/08	A 4 J 0 0 2
G 0 2 F 1/1335	5 1 0	G 0 2 F 1/1335	5 1 0
審査請求 未請求 請求項の数 8 O L (全 11 頁) 最終頁に続く			

(21)出願番号 特願2001-35665(P2001-35665)

(22)出願日 平成13年2月13日(2001.2.13)

(71)出願人 000003964

日東電工株式会社

大阪府茨木市下穂積1丁目1番2号

(72)発明者 宮武 稔

大阪府茨木市下穂積1丁目1番2号日東電  
工株式会社内

(74)代理人 100088007

弁理士 藤本 勉

最終頁に続く

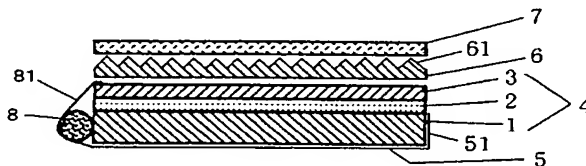
(54)【発明の名称】 光学素子、偏光面光源及び液晶表示装置

(57)【要約】

【課題】 直線偏光からなる出射光が得られてその偏光方向(振動面)も任意に制御できる光学素子の開発。

【解決手段】 発光性材料を含有させた透光性樹脂板(1)の片面又は両面に、複屈折性の微小領域を分散含有して偏光方向により散乱異方性を示す偏光散乱板(3)を設けてなる積層体(4)の片面に鏡面反射層(5)を有する光学素子、その光学素子の少なくとも一側面に光源(8)を有する偏光面光源及び前記光学素子を用いてなる照明装置を具備する液晶表示装置。

【効果】 透光性樹脂板に反射ドット等の特別な光出射手段を形成する必要なく側面や表面等より光を入射させて表裏面の一方より励起発光による直線偏光を効率よく出射し、偏光散乱板の光軸を介し直線偏光の振動方向を任意に制御して輝度に優れる液晶表示素子を形成できる。



## 【特許請求の範囲】

【請求項 1】 発光性材料を含有させた透光性樹脂板の片面又は両面に、複屈折性の微小領域を分散含有して偏光方向により散乱異方性を示す偏光散乱板を設けてなる積層体の片面に鏡面反射層を有することを特徴とする光学素子。

【請求項 2】 請求項 1 において、発光性材料が紫外線又は可視光を吸収して可視光又は可視光の燐光を放射する蛍光材料又は蓄光材料からなる光学素子。

【請求項 3】 請求項 1 又は 2 において、偏光散乱板が透明フィルム中に、そのフィルムを形成するポリマーのガラス転移温度よりも低温でネマチック液晶層を呈するガラス転移温度 50℃以上の液晶ポリマーからなる微小領域を分散含有するものである光学素子。

【請求項 4】 請求項 1～3 に記載の光学素子の少なくとも一側面に光源を配置してなることを特徴とする偏光面光源。

【請求項 5】 請求項 1～3 に記載の光学素子を用いてなる照明装置を具備することを特徴とする液晶表示装置。

【請求項 6】 請求項 5 において、照明装置が光学素子における透光性樹脂板の少なくとも一側面に光源を有するものからなる液晶表示装置。

【請求項 7】 請求項 5 又は 6 において、光学素子が液晶表示装置の表示部分に対し 120%以上の面積を有する透光性樹脂板と、90～110%の面積を有する偏光散乱板及び鏡面反射層との積層一体化物からなる液晶表示装置。

【請求項 8】 請求項 7 において、透光性樹脂板の偏光散乱板を有しない部分が液晶表示装置のハウジングの外側に突出し、その突出部に外光が入射しうる状態にある液晶表示装置。

## 【発明の詳細な説明】

## 【0001】

【発明の技術分野】 本発明は、側面又は表裏面からの入射光を介して励起発光した光を表裏面の一方より振動面が制御された状態で直線偏光が出射する光学素子及びそれを用いた偏光面光源と液晶表示装置に関する。

## 【0002】

【発明の背景】 従来、液晶表示装置のバックライトとして用いられるサイドライト型導光板としては、透光性樹脂板に酸化チタンや硫酸バリウム等の高反射率顔料含有の反射ドット等からなる光出射手段を設けてその光出射手段を介し板内の全反射による伝送光を散乱等により板表裏の一方より出射させるようにしたもののが知られていた。しかしながら前記の出射光は殆ど偏光特性を示さない自然光であり、液晶表示に際してはそれを偏光板を介し直線偏光に変換する必要のあることから、偏光板による吸収ロスを生じて光の利用効率が 50%を超え得ない問題点があった。

【0003】 前記に鑑みて、プリズム角を利用して直線偏光が得られる偏光分離板と位相差板を組合せた偏光変換手段を併用するシステムなども提案されている。

(特開平 6-18873 号公報、特開平 6-160840 号公報、特開平 6-265892 号公報、特開平 7-72475 号公報、特開平 7-261122 号公報、特開平 7-270792 号公報、特開平 9-54556 号公報、特開平 9-105933 号公報、特開平 9-138406 号公報、特開平 9-152604 号公報、特開平 9-293406 号公報、特開平 9-326205 号公報、特開平 10-78581 号公報等)。しかしながら斯かるバックライトにては充分な偏光が得られず偏光方向の制御も困難なことなどから実用性に乏しい難点があった。

## 【0004】

【発明の技術的課題】 本発明は、直線偏光からなる出射光が得られてその偏光方向(振動面)も任意に制御でき、外光の利用も可能な導光板などとして用いられる光学素子の開発を課題とする。

## 【0005】

【課題の解決手段】 本発明は、発光性材料を含有させた透光性樹脂板の片面又は両面に、複屈折性の微小領域を分散含有して偏光方向により散乱異方性を示す偏光散乱板を設けてなる積層体の片面に鏡面反射層を有することを特徴とする光学素子、及びその光学素子の少なくとも一側面に光源を配置してなることを特徴とする偏光面光源、並びに前記の光学素子を用いてなる照明装置を具備することを特徴とする液晶表示装置を提供するものである。

## 【0006】

【発明の効果】 本発明によれば、上記の構成により透光性樹脂板に反射ドット等の特別な光出射手段を形成する必要なく側面より入射した自然光や表裏より入射した外光による励起光を表裏面の鏡面反射層を有しない一方より直線偏光として効率よく出射させることができ、かつ併用の偏光散乱板の光軸を介してそれに応じた振動方向の直線偏光を得ることができる。従って偏光散乱板の光軸制御で直線偏光の振動方向を任意に変えることができる。また透光性樹脂板を液晶表示装置より突出させてその突出部に入射した光を表示部分に対し直線偏光として供給でき弱い光にても明るい表示を達成することができる。

【0007】 すなわち前記において側面又は表裏よりの入射光による励起光の大部分は、空気界面との屈折率差により全反射されて透光性樹脂板内を伝送されつつ偏光散乱板に入射しその入射光の内、微小領域との最大屈折率差( $\Delta n_1$ )を示す軸方向( $\Delta n_1$  方向)に平行な振動面を有する直線偏光が選択的に強く散乱されてその一部が全反射角よりも小さい角度となり光学素子より出射する。その場合、鏡面反射層を設けた側では出射が遮ら

れ反対面に供給されてその面（鏡面反射層を有しない光学素子の表裏一方の面）に出射光が集中される結果、光学素子の一面より直線偏光が出射する。

【0008】ちなみに透光性樹脂板中の発光材料による励起発光は、立体角の関係上約80%が該樹脂板中に閉込められて全反射を繰り返している状態である。その閉込められた光は、前記した偏光散乱板による散乱によって全反射条件が壊された時のみ光学素子より出射するため偏光散乱板の面積部分、ひいてはその面積を対応させて液晶表示素子の表示部分のみに出射光を集中させることが可能となる。一方、前記の $\Delta n1$ 方向の散乱で大きい角度で散乱された光、及び $\Delta n1$ 方向条件を満足した光が散乱を受けなかった光、加えて $\Delta n1$ 方向以外の振動方向を有する光は、透光性樹脂板内に閉込められて全反射を繰り返しつつ伝送され偏光散乱板による複屈折位相差などにより偏光状態も解消されて前記の $\Delta n1$ 方向条件を満足して出射する機会を待つ。以上の繰り返しにより光学素子より所定振動面の直線偏光が効率よく出射される。

【0009】

【発明の実施形態】本発明による光学素子は、発光材料を含有させた透光性樹脂板の片面又は両面に、複屈折性の微小領域を分散含有して偏光方向により散乱異方性を示す偏光散乱板を設けてなる積層体の片面に鏡面反射層を有するものよりなる。その例を図1に示した。1が透光性樹脂板、3が偏光散乱板で、4がそれらの積層体であり、5が鏡面反射層である。なお2、6、7は、それぞれ必要に応じての接着層、レンズシート、光拡散層である。なお図1は、偏光面光源としたものを例示しており、8が光源である。

【0010】透光性樹脂板は、光源の波長域に応じそれに透明性を示す適宜な材料の1種又は2種以上を用いて形成された板状物であればよい。ちなみに可視光域では例えばアクリル系樹脂やポリカーボネート系樹脂、スチレン系樹脂やノルボルネン系樹脂、エポキシ系樹脂などからなる板が好ましく用いられる。光透過率の点よりは屈折率が可及的に小さい樹脂からなる板が好ましい。また出射光の偏光特性を維持する点よりは面内方向の位相差が可及的に小さい樹脂板が好ましく、斯かる点よりは板を成形する際に歪み等による配向複屈折を生じにくい材料、特にポリメチルメタレートやノルボルネン系樹脂などが好ましく用いられる。斯かる樹脂は、板の成形性にも優れている。

【0011】透光性樹脂板の形状は、液晶表示装置、就中その液晶セルのサイズや光源の特性、出射光の輝度の均一化などに応じて適宜に決定することができ特に限定はない。成形の容易性等の点よりは平板や楔形の板などが好ましいが、液晶表示装置等の適用対象のハウジング形状などに応じて自由な形とすることができる。ちなみに携帯電話等でスケルトンタイプの如く電話ボディ自体

が透光性材料からなる場合には、そのボディが透光性樹脂板を兼ねる構造などとすることもできる。

【0012】透光性樹脂板の厚さについても光源や液晶セルのサイズなどに応じて適宜に決定でき特に限定はないが、薄型軽量化等を目的に可及的に薄いことが好ましく就中10mm以下、特に0.5～5mmが好ましい。さらに外光等の周囲光を採光することを目的とする場合には、液晶表示装置の表示面（液晶セル）のサイズよりも大きい面積の透光性樹脂板とすることが好ましい。

【0013】透光性樹脂板の形成は、例えば射出成形方式や注型成形方式、押出成形方式や流延成形方式、圧延成形方式やロール塗工成形方式、トランスファ成形方式や反応射出成形方式（RIM）などの適宜な方式にて行うことができる。その形成に際しては発光性材料が配合され、さらに必要に応じて例えば変色防止剤や酸化防止剤、紫外線吸収剤や離型剤などの適宜な添加剤を配合することができる。

【0014】透光性樹脂板に含有させる前記した発光性材料としては、紫外線又は可視光を吸収して可視光領域の波長光を励起発光する適宜な材料の1種又は2種以上を用いることができ特に制限はない。ちなみにその例としては励起1重項からの発光である蛍光や3重項からの発光である燐光などを放射する有機染料や無機顔料等からなる、例えば特公平3-40293号公報等による蛍光材料や蓄光材料などがあげられる。

【0015】発光性材料は、透光性樹脂板中に可及的に均一分散していることが均一発光等の点より好ましく、その分散物のサイズは不必要な散乱の抑制の点より可及的に小さいことが好ましい。透光性樹脂板中への発光性材料の分散は、例えば透光性樹脂板を形成する際にその成形用樹脂に予め発光性材料を必要に応じて他の添加剤と共に配合しておく方式などの適宜な方式にて行うことができる。

【0016】一方、偏光散乱板としては複屈折性の微小領域を分散含有して偏光方向により散乱異方性を示す適宜なものを用いられる。ちなみにその例としては透明フィルム中に複屈折性の微小領域を分散含有させたものなどがあげられる。その形成は、例えばポリマー類や液晶類等の透明性に優れる適宜な材料の1種又は2種以上を、延伸処理等による適宜な配向処理で複屈折性が相違する領域を形成する組合せで用いて配向フィルムを得る方式などの適宜な方式にて行うことができる。

【0017】ちなみに前記の組合せ例としては、ポリマー類と液晶類の組合せ、等方性ポリマーと異方性ポリマーの組合せ、異方性ポリマー同士の組合せなどがあげられる。微小領域の分散分布性などの点より相分離する組合せが好ましく、組合せる材料の相溶性により分散分布性を制御することができる。相分離は、例えば非相溶性の材料を溶媒にて溶液化する方式や、非相溶性の材料を加熱溶融下に混合する方式などの適宜な方式で行うこと

ができる。

【0018】前記の組合せにて延伸方式により配向処理する場合、ポリマー類と液晶類の組合せ及び等方性ポリマーと異方性ポリマーの組合せでは任意な延伸温度や延伸倍率にて、異方性ポリマー同士の組合せでは延伸条件を適宜に制御することにより目的の偏光散乱板を形成することができる。なお異方性ポリマーでは延伸方向の屈折率変化の特性に基づいて正負に分類されるが、本発明においては正負いずれの異方性ポリマーも用いることができ、正同士や負同士、あるいは正負の組合せのいずれ

【0019】前記したポリマー類の例としては、ポリエチレンテレフタレートやポリエチレンナフタレートの如きエステル系ポリマー、ポリスチレンやアクリロニトリル・スチレン共重合体（ASポリマー類）の如きスチレン系ポリマー、ポリエチレンやポリプロピレン、シクロ系ないしノルボルネン構造を有するポリオレフィンやエチレン・プロピレン共重合体の如きオレフィン系ポリマー、ポリメチルメタクリレートの如きアクリル系ポリマー、二酢酸セルロースや三酢酸セルロースの如きセルロース系ポリマー、ナイロンや芳香族ポリアミドの如きアミド系ポリマーがあげられる。

【0020】またカーボネート系ポリマーや塩化ビニル系ポリマー、イミド系ポリマーやスルホン系ポリマー、ポリエーテルスルホンやポリエーテルエーテルケトン、ポリフェニレンスルフィドやビニルアルコール系ポリマー、塩化ビニリデン系ポリマーやビニルブチラール系ポリマー、アリレート系ポリマーやポリオキシメチレン、シリコン系ポリマーやウレタン系ポリマー、エーテル系ポリマーや酢酸ビニル系ポリマー、前記ポリマーのブレンド物、あるいはフェノール系やメラミン系、アクリル系やウレタン系、ウレタンアクリル系やエポキシ系やシリコン系等の熱硬化型、ないし紫外線硬化型のポリマー類なども前記した透明ポリマーの例としてあげられる。

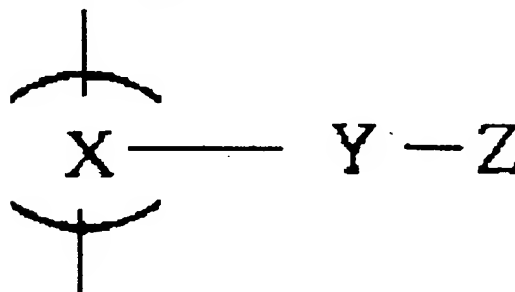
【0021】一方、液晶類の例としてはシアノビフェニル系やシアノフェニルシクロヘキサン系、シアノフェニルエステル系や安息香酸フェニルエステル系、フェニルピリミジン系やそれらの混合物の如き室温又は高温でネマチック相やスメクチック相を呈する低分子液晶や架橋性液晶モノマー、あるいは室温又は高温でネマチック相やスメクチック相を呈する液晶ポリマーなどがあげられる。前記の架橋性液晶モノマーは通例、配向処理した後、熱や光等による適宜な方式で架橋処理されてポリマーとされる。

【0022】耐熱性や耐久性等に優れる偏光散乱板を得る点よりは、ガラス転移温度が50℃以上、就中80℃以上、特に120℃以上のポリマー類と、架橋性液晶モノマーないし液晶ポリマーとの組合せで用いることが好ましい。その液晶ポリマーとしては主鎖型や側鎖型の

適宜なものを用いることができ、その種類について特に限定はない。粒径分布の均一性に優れる微小領域の形成性や熱的安定性、フィルムへの成形性や配向処理の容易性などの点より好ましく用いうる液晶ポリマーは、重合度が8以上、就中10以上、特に15～5000のものである。

【0023】液晶ポリマーを用いての偏光散乱板の形成は、例えばポリマー類の1種又は2種以上と、微小領域を形成するための液晶ポリマーの1種又は2種以上を混合し、液晶ポリマーを微小領域の状態で分散含有するポリマーフィルムを形成して適宜な方式で配向処理し、複屈折性が相違する領域を形成する方法などにて行うことができる。配向処理による上記した屈折率差 $\Delta n_1$ 、 $\Delta n_2$ の制御性などの点よりは、ガラス転移温度が50℃以上で、併用のポリマー類のガラス転移温度よりも低い温度域でネマチック液晶相を呈するものが好ましく用いうる。ちなみにその具体例としては下記的一般式で表されるモノマー単位を有する側鎖型の液晶ポリマーなどがあげられる。

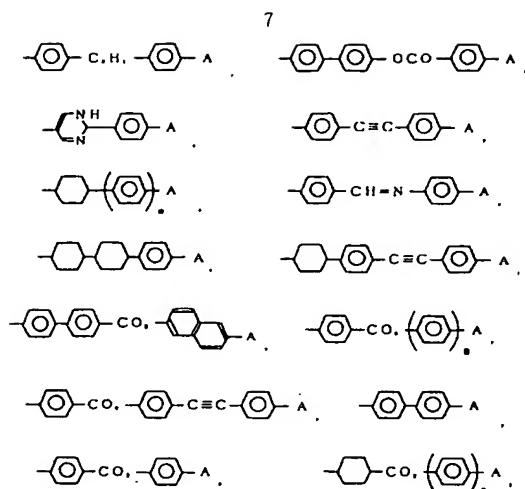
【0024】一般式：



【0025】前記の一般式においてXは、液晶ポリマーの主鎖を形成する骨格基であり、線状や分岐状や環状等の適宜な連結鎖にて形成されてよい。ちなみにその例としてはポリアクリレート類やポリメタクリレート類、ポリ $\alpha$ -ハロアクリレート類やポリ $\alpha$ -シアノアクリレート類、ポリアクリルアミド類やポリアクリロニトリル類、ポリメタクリロニトリル類やポリアミド類、ポリエステル類やポリウレタン類、ポリエーテル類やポリイミド類、ポリシロキサン類などがあげられる。

【0026】またYは、主鎖より分岐するスペーサ基であり、屈折率制御等の偏光散乱板の形成性などの点より好ましいスペーサ基Yは、例えばエチレンやプロピレン、ブチレンやペンチレン、ヘキシレンやオクチレン、デシレンやウンデシレン、ドデシレンやオクタデシレン、エトキシエチレンやメトキシブチレンなどである。

【0027】一方、Zは液晶配向性を付与するメソゲン基であり、下記の化合物などがあげられる。



【0028】前記化合物における末端置換基Aは、例えばシアノ基やアルキル基、アルケニル基やアルコキシ基、オキサアルキル基や水素の1個以上がフッ素又は塩素にて置換されたハロアルキル基やハロアルコキシ基やハロアルケニル基などの適宜なものであってよい。

【0029】前記において、スペーサ基Yとメソゲン基Zはエーテル結合、すなわち-O-を介して結合していてもよい。またメソゲン基Zにおけるフェニル基は、その1個又は2個の水素がハロゲンで置換されていてもよく、その場合、ハロゲンとしては塩素又はフッ素が好ましい。

【0030】上記したネマチック配向性の側鎖型液晶ポリマーは、前記の一般式で表されるモノマー単位を有するホモポリマーやコポリマー等の適宜な熱可塑性ポリマーであればよく、就中モノドメイン配向性に優れるものが好ましい。

【0031】ネマチック配向性の液晶ポリマーを用いた偏光散乱板の形成は、例えばポリマーフィルムを形成するためのポリマー類と、そのポリマー類のガラス転移温度よりも低い温度域でネマチック液晶相を呈するガラス転移温度が50℃以上、就中60℃以上、特に70℃以上の液晶ポリマーを混合して、液晶ポリマーを微小領域の状態で分散含有するポリマーフィルムを形成した後、その微小領域を形成する液晶ポリマーを加熱処理してネマチック液晶相に配向させ、その配向状態を冷却固定する方法などにて行うことができる。

【0032】上記した微小領域を分散含有するポリマーフィルム、すなわち配向処理対象のフィルムの形成は、例えばキャスト法や押出成形法、射出成形法やロール成形法、流延成形法などの適宜な方式にて得ることができ、モノマー状態で展開しそれを加熱処理や紫外線等の放射線処理などにより重合してフィルム状に製膜する方法などにて行うことができる。

【0033】微小領域の均等分布性に優れる偏光散乱板を得る点などよりは、溶媒を介した形成材の混合液をキャスト法や流延成形法等にて製膜する方式が好ま

しい。その場合、溶媒の種類や混合液の粘度、混合液展開層の乾燥速度等により微小領域の大きさや分布性などを制御することができる。ちなみに微小領域の小面積化には混合液の低粘度化や混合液展開層の乾燥速度の急速化などが有利である。

【0034】配向処理対象のフィルムの厚さは、適宜に決定しうるが、一般には配向処理性などの点より1μm～3mm、就中5μm～1mm、特に10～500μmとされる。なおフィルムの形成に際しては、例えば分散剤や界面活性剤、紫外線吸収剤や色調調節剤、難燃剤や離型剤、酸化防止剤などの適宜な添加剤を配合することができる。

【0035】配向処理は、上記した如く例えば1軸や2軸、逐次2軸やZ軸等による延伸処理方式や圧延方式、ガラス転移温度又は液晶転移温度以上の温度で電場又は磁場を印加して急冷し配向を固定化する方式や製膜時に流動配向させる方式、等方性ポリマーの僅かな配向に基づいて液晶を自己配向させる方式などの、配向により屈折率を制御しうる適宜な方式の1種又は2種以上を用いて行うことができる。従って得られた偏光散乱板は、延伸フィルムであってもよいし、非延伸フィルムであってもよい。なお延伸フィルムとする場合には、脆性ポリマーも用いるが、延び性に優れるポリマーが特に好ましく用いる。

【0036】また微小領域が上記した液晶ポリマーからなる場合には、例えばポリマーフィルム中に微小領域として分散分布する液晶ポリマーがネマチック相等の目的とする液晶相を呈する温度に加熱して溶融させ、それを配向規制力の作用下に配向させて急冷し、配向状態を固定化する方式などにも行うことができる。微小領域の配向状態は、可及的にモノドメイン状態にあることが光学特性のバラツキ防止などの点より好ましい。

【0037】なお前記の配向規制力としては、例えばポリマーフィルムを適宜な倍率で延伸処理する方式による延伸力やフィルム形成時のシェアリング力、電界や磁界などの、液晶ポリマーを配向せうる適宜な規制力を適用でき、その1種又は2種以上の規制力を作用させて液晶ポリマーの配向処理を行うことができる。

【0038】従って偏光散乱板における微小領域以外の部分は、複屈折性を示すものであってもよいし、等方性のものであってもよい。偏光散乱板の全体が複屈折性を示すものは、フィルム形成用のポリマー類に配向複屈折性のものを用いて上記した製膜過程における分子配向などにより得ることができ、必要に応じ例えば延伸処理等の公知の配向手段を加えて複屈折性を付与しない制御することができる。また微小領域以外の部分が等方性の偏光散乱板は、例えばフィルム形成用のポリマー類に等方性のものを用いて、そのフィルムを当該ポリマー類のガラス転移温度以下の温度領域で延伸処理する方式などにより得ることができる。

【0039】好ましく用いる偏光散乱板は、微小領域とそれ以外の部分、すなわちポリマーフィルムからなる部分との、微小領域の各光軸方向における屈折率差 $\Delta n_1$ 、 $\Delta n_2$ 、 $\Delta n_3$ が最大値を示す軸方向（ $\Delta n_1$ 方向）において0.03以上（ $\Delta n_1$ ）であり、かつその $\Delta n_1$ 方向と直交する残る2軸方向（ $\Delta n_2$ 方向、 $\Delta n_3$ 方向）において前記 $\Delta n_1$ の50%以下（ $\Delta n_2$ 、 $\Delta n_3$ ）となるように制御したものであり、その $\Delta n_2$ と $\Delta n_3$ の等しいものがより好ましい。

【0040】前記の屈折率差とすることにより、 $\Delta n_1$  10 方向の直線偏光が強く散乱され全反射角よりも小さい角度で散乱されて光学素子より出射する光量を増やすことができ、それ以外の方向の直線偏光は散乱されにくくて全反射を繰り返し、光学素子内に閉じ込めることができる。

【0041】なお前記において微小領域の各光軸方向と微小領域以外の部分との屈折率差は、フィルムを形成するポリマーが光学的等方性のものである場合には、微小領域の各光軸方向の屈折率とポリマーフィルムの平均屈折率との差を意味し、フィルムを形成するポリマーが光 20 学的異方性のものである場合には、ポリマーフィルムの主光軸方向と微小領域の主光軸方向とが通常は一致しているためそれぞれの軸方向における各屈折率の差を意味する。

【0042】前記した全反射の点より $\Delta n_1$ 方向における屈折率差 $\Delta n_1$ は、適度に大きいことが好ましく、就中0.035～1、特に0.045～0.5の屈折率差 $\Delta n_1$ であることが好ましい。 $\Delta n_2$ 方向と $\Delta n_3$ 方向における屈折率差 $\Delta n_2$ 、 $\Delta n_3$ は、適度に小さいことが好ましい。斯かる屈折率差は、使用材料の屈折率や上 30 記した配向操作などにより制御することができる。

【0043】また前記の $\Delta n_1$ 方向は、光学素子より出射される直線偏光の振動面であることより、斯かる $\Delta n_1$ 方向は偏光散乱板面に平行であることが好ましい。なお面内における斯かる $\Delta n_1$ 方向は、目的とする液晶表示装置等に応じた適宜な方向とすることができる。

【0044】偏光散乱板における微小領域は、前記散乱効果等の均質性などの点より可及的に均等に分散分布していることが好ましい。微小領域の大きさ、特に散乱方向である $\Delta n_1$ 方向の長さは、後方散乱（反射）や波長 40 依存性に関係する。

【0045】光利用効率の向上や波長依存性による着色の防止、微小領域の視覚による視認阻害の防止ないし鮮明な表示の阻害防止、さらには製膜性やフィルム強度などの点より微小領域の好ましい大きさ、特に $\Delta n_1$ 方向の好ましい長さは、0.05～500 $\mu\text{m}$ 、就中0.1～250 $\mu\text{m}$ 、特に1～100 $\mu\text{m}$ である。なお微小領域は、通例ドメインの状態では偏光散乱板中に存在するが、その $\Delta n_2$ 方向等の長さについては特に限定はない。

【0046】偏光散乱板中に占める微小領域の割合は、 50

$\Delta n_1$ 方向の散乱性などの点より適宜に決定しうが、一般にはフィルム強度なども踏まえて0.1～70重量%、就中0.5～50重量%、特に1～30重量%とされる。

【0047】偏光散乱板は、上記した複屈折特性を示すフィルムの単層にて形成することもできるし、斯かるフィルムを2層以上重畳したものとして形成することもできる。当該フィルムの重畳化により、厚さ増加以上の相乗的な散乱効果を発揮させることができる。重畳体は、 $\Delta n_1$ 方向又は $\Delta n_2$ 方向等の任意な配置角度で当該フィルムを重畳したものであってもよいが、散乱効果の拡大などの点よりは $\Delta n_1$ 方向が上下の層で平行関係となるように重畳したものが好ましい。当該フィルムの重畳数は、2層以上の適宜な数とすることができる。

【0048】重畳する当該フィルムは、 $\Delta n_1$ 又は $\Delta n_2$ 等が同じものであってもよいし、異なるものであってもよい。なお $\Delta n_1$ 方向等における上下の層での平行関係は、可及的に平行であることが好ましいが、作業誤差によるズレなどは許容される。また $\Delta n_1$ 方向等にバラツキがある場合には、その平均方向に基づく。

【0049】重畳体における当該フィルムは、全反射界面が最表面となるように接着層等を介して接着される。その接着には例えばホットメルト系や粘着系などの適宜な接着剤を用いる。反射損を抑制する点よりは、当該フィルムとの屈折率差が可及的に小さい接着層が好ましく、当該フィルムやその微小領域を形成するポリマーにて接着することもできる。

【0050】なお偏光散乱板は、光学素子内を光が伝送する過程で適宜に偏光状態が解消される必要があることより板の全体で又は部分的に位相差を有することが好ましい。基本的には偏光散乱板の遅相軸と散乱されにくい直線偏光の偏光軸（振動面）とは直交関係にあるため位相差による偏光変換は起きにくい、僅かな散乱によって見かけの角度が変化し、偏光変換が生じるものと考えられる。

【0051】前記した偏光変換の点より一般には5nm以上の面内位相差のあることが好ましいが、偏光散乱板の厚さによりその値は変化する。なおその位相差の付与は、複屈折性の微粒子を含有させる方式や表面に付着させる方式、ポリマーフィルムを複屈折性とする方式、それらを併用する方式などの適宜な方式にて行うことができる。

【0052】本発明による光学素子は、発光性材料含有の透光性樹脂板と偏光散乱板との積層体を用いたものであるが、その形成に際しては図1に例示した如く透光性樹脂板1と偏光散乱板3との界面での反射を可及的に抑制するため、すなわち透光性樹脂板と偏光散乱板との間の伝送光の透過を容易としてそれらの密着一体物からなる積層体の表裏面での全反射を達成するため可及的に屈折率の近い接着剤等にて接着されていることが好まし

い。接着処理は、軸関係のズレ防止などの点よりも有効である。なお光学素子の形成に際しては、図2に例示した如く透光性樹脂板1の表裏両面に偏光散乱板3を設けることもできる。

【0053】前記の接着処理は、上記した重量型の偏光散乱板に準じて例えばアクリル系やシリコン系、ポリエステル系やポリウレタン系、ポリエーテル系やゴム系等の透明な粘着剤などの適宜な接着剤を用いることができ、特に限定はない。光学特性の変化を防止する点などよりは、硬化や乾燥に高温プロセスを要さず、長時間の硬化や乾燥処理を要しないものが好ましい。また加熱や加湿の条件下に浮きや剥がれ等の剥離問題を生じないものが好ましい。

【0054】前記の点よりメチル基やエチル基やブチル基等の炭素数が20以下のアルキル基を有する（メタ）アクリル酸のアルキルエステルと、（メタ）アクリル酸や（メタ）アクリル酸ヒドロキシエチル等の改良成分からなるアクリル系モノマーを、ガラス転移温度が0℃以下となる組合せにて共重合してなる、重量平均分子量が10万以上のアクリル系重合体をベースポリマーとするアクリル系粘着剤などが好ましく用いられる。アクリル系粘着剤は、透明性や耐候性や耐熱性などに優れる利点も有している。

【0055】透光性樹脂板又は／及び偏光散乱板への粘着層の付設は、適宜な方式で行いうる。その例としてはトルエンや酢酸エチル等の適宜な溶剤の単独物又は混合物からなる溶媒に粘着剤成分を溶解又は分散させて10～40重量％程度の粘着剤液を調製し、それを流延方式や塗工方式等の適宜な展開方式で透光性樹脂板や偏光散乱板の上に直接付設する方式、あるいは前記に準じセパレータ上に粘着層を形成してそれを透光性樹脂板や偏光散乱板の上に移着する方式などがあげられる。設ける粘着層は、異なる組成又は種類等のものの重量層であってもよい。

【0056】接着層の厚さは、接着力等に応じて適宜に決定でき、一般には1～500μmとされる。接着層には必要に応じて例えば天然物や合成物の樹脂類、ガラス繊維やガラスビーズ、金属粉やその他の無機粉末等からなる充填剤や顔料、着色剤や酸化防止剤などの適宜な添加剤を配合することもできる。

【0057】図1に例示の如く透光性樹脂板1と偏光散乱板3の積層体4の片面に設ける鏡面反射層5は、その反射層配置側より出射する光を鏡面反射層を介し偏光状態を変化させることなく反転させて出射光を光学素子の表裏面の一方に集中させて輝度を向上させることを目的とする。

【0058】前記の反射層としては偏光状態の維持の点より可及的に鏡面であることが好ましく、斯かる点より金属や誘電体多層膜からなる反射面が好ましい。その金属としては例えばアルミニウムや銀、クロムや金、銅や

錫、亜鉛やインジウム、パラジウムや白金、あるいはその合金などの適宜なものを用いうる。

【0059】鏡面反射層は、蒸着方式等による金属薄膜の付設層などとして積層体に直接密着させることもできるが、完全反射は困難でやはり反射層による若干の吸収が生じ全反射による繰り返しを考慮すると吸収損失が懸念され、それを防止する点よりは反射板を単に重ね置くだけの空気層が介在しうる配置方式が好ましい。

【0060】従って斯かる点より鏡面反射層は、例えば支持基材にスパッタリング方式や蒸着方式等にて金属薄膜を付設した反射板、金属箔や金属の圧延シートなどの板状のものが好ましく用いうる。上記した反射層の支持基材には、ガラス板や樹脂シートなどの適宜なものを用いうる。就中、反射率や色味、取扱性などの点より銀やアルミニウム等を樹脂シートに蒸着したものなどが好ましく用いうる。また誘電体多層膜よりなる鏡面反射層については公知例（例えば特表平10-511322号公報）などに準じることができる。なお反射層は、積層体の表裏のいずれに配置してもよい。

【0061】一方、積層体の反対面、すなわち前記の鏡面反射層を配置しない面には、必要に応じ図1の例の如く偏光維持性のレンズシート6や光拡散板7などの適宜な光学層を配置することもできる。斯かるレンズシートは、積層体よりの散乱性の出射光（直線偏光）をその偏光度を可及的に維持しつつ光路制御して視認に有利な正面方向への指向性を向上させ、散乱性の出射光の強度ピークを正面方向とすることなどを目的とする。

【0062】レンズシートとしては、片面（裏面）より入射した散乱光を光路制御して他面（表面）よりシート面に可及的に垂直（正面）な方向に効率よく出射するようにした適宜なものを用いることができ、特に限定はない。従って偏光維持性の点を除き従来のサイドライト型導光板で使用する各種のレンズ形態を有するいずれのものも用いうる（例えば特開平5-169015号公報等）。好ましく用いられるレンズシートは、例えば80％以上、就中85％以上、特に90％以上の全光線透過率を示し、クロスニコル間に配置した場合に偏光解消による漏れ光（透過率）が5％以下、就中2％以下、特に1％以下である如く、光透過度に優れて、出射光の偏光特性が可及的に解消されないものである。

【0063】一般に偏光の解消が複屈折や多重散乱により生じることより、例えば前記した偏光維持性を示すレンズシートは、複屈折を可及的に低減すること、光線の軌跡において平均反射（散乱）回数を減らすことなどにより達成でき、具体的には例えば上記した透光性樹脂板や偏光散乱板で例示したポリマー就中、三酢酸セルロース系樹脂やポリメタクリル酸メチル、ポリカーボネートやノルボルネン系樹脂の如き複屈折性の低い樹脂（光学的等方性の良好な樹脂）を1種又は2種以上用いてレンズシートを形成する方式などにより得ることができる。



【0064】上記のようにレンズシートとしては、例えば屈折率が相違する樹脂を含有することもある透明な樹脂基材の表面又は内部に光重合体を介し屈折率を制御してなる凸レンズ型や屈折率分布型（G1型）のレンズ領域、特に微小なレンズ領域を多数形成したものや、透明な樹脂基材に設けた多数の貫通孔に屈折率相違の重合体を充填してレンズ領域を形成したもの、あるいは多数の球状レンズを単層配置してそれを薄膜にて固定したものなどの適宜なレンズ形態を有するものであってよいが、屈折率の相違を介した光路制御の点などよりは図1に例示の如くシート6の片面又は両面、特に片面に凹凸構造からなるレンズ形態61を有するものが好ましい。

【0065】前記のレンズ形態を形成する凹凸構造は、シートを透過した光の光路を制御してその透過光を正面方向に集光する機能を発揮するものであればよく、例えば断面三角形等の線状の溝や突起がストライプ状や格子状に多数配列したもの、あるいは三角錐や四角錐、その他の多角錐や円錐等の底面形状を有する錐体状の微小突起が点状に多数配列したものなどがあげられる。なお線状又は点状の凹凸構造は、球状レンズや非球面レンズ、半円筒レンズなどであってもよく、適宜なレンズ形態を有するものであってよい。

【0066】前記した線状又は点状の凹凸構造を有するレンズシートの形成は、例えば所定の凹凸構造が形成されるように形成した型に樹脂液や樹脂形成用のモノマーを充填し必要に応じ重合処理して当該型の凹凸構造を転写する方式や当該型に樹脂シートを加熱圧着してその凹凸構造を転写する方式などの適宜な方式にて行うことができる。なおレンズシートは、支持シートにレンズ形態を付加したものの如く同種又は異種の樹脂層の二層以上の重畳層などとして形成されていてもよい。

【0067】レンズシートは、積層体の光出射側に1層又は2層以上配置することができる。2層以上配置する場合、そのレンズシートは同じものであってもよいし、異なるものであってもよいが、その全体として偏光維持性を保持することが好ましい。配置するレンズシートが積層体に隣接することとなる場合には、上記した鏡面反射層の場合と同様に積層体に対し空隙が生じるように配置されていることが好ましい。またその空隙は、全反射の点より入射光の波長よりも充分に大きいことが好ましい。

【0068】なおレンズシートにおけるレンズ形態が線状の凹凸構造からなる場合には、正面方向への光路制御等の点よりその線方向が偏光散乱板の光軸方向（出射偏光の振動面方向）と平行状態又は直交状態となるように配置することが好ましい。また斯かるレンズシートを2層以上配置する場合には、上下の層で線方向が交差するように配置することが光路制御の効率の点より好ましい。

【0069】光拡散板は、出射光（直線偏光）をその偏

光度を可及的に維持しつつ拡散して発光を均一化したり、レンズシートのパターンの視覚を緩和したりして視認性を向上させることなどを目的とする。光拡散板は、レンズシートに代えて、あるいはレンズシートと積層体の間又はレンズシートの光出射側等の適宜な位置に1層又は2層以上を配置することができる。

【0070】光拡散層としては、上記したレンズシートに準じて光透過度に優れ、出射光の偏光特性を可及的に維持するものが好ましく用いられる。従って光拡散層の形成には、上記のレンズシートで例示した複屈折率の小さい樹脂が好ましく用いられ、例えばその樹脂層中に透明粒子を分散含有するものや、表面に微細凹凸構造を有する樹脂層などとして斯かる偏光維持性の光拡散層を得ることができる。

【0071】なお前記の樹脂層中に分散含有させる透明粒子としては、例えばシリカないしガラスやアルミナ、チタニアやジルコニア、酸化錫や酸化インジウム、酸化カドミウムや酸化アンチモン等からなる導電性のこともある無機系微粒子、あるいはアクリル系ポリマーやポリアクリロニトリル、ポリエステルやエポキシ系樹脂、メラミン系樹脂やウレタン系樹脂、ポリカーボネートやポリスチレン、シリコーン系樹脂やベンゾグアナミン、メラミン・ベンゾグアナミン縮合物やベンゾグアナミン・ホルムアルデヒド縮合物の如き架橋又は未架橋のポリマー等からなる有機系微粒子などがあげられる。

【0072】透明粒子は、1種又は2種以上を用いることができ、粒径は光の拡散性やその拡散の均等性などの点より1～20 $\mu\text{m}$ が好ましい。一方、粒形は任意であるが、一般には（真）球形やその2次凝集体などが用いられる。特に偏光維持性の点よりは樹脂との屈折率比が0.9～1.1の透明粒子が好ましく用いられる。粒子含有の光拡散層は、例えば樹脂の熔融液に透明粒子を混合してシート等に出射し成形する方式、樹脂の溶液やモノマーに透明粒子を配合しシート等にキャストして必要に応じ重合処理する方式、透明粒子含有の樹脂液を所定面や偏光維持性の支持フィルム等に塗工する方式などの従来に準じた適宜な方式にて形成することができる。

【0073】一方、表面に微細凹凸構造を有する光拡散層の形成は、例えばサンドブラスト等によるパフ処理やエンボス加工方式等により樹脂からなるシートの表面を粗面化する方式、当該シートの表面に突起を有する透光性材料の層を形成する方式などの適宜な方式にて行うことができる。ただし、空気等の気泡や酸化チタン微粒子などの樹脂との屈折率差が大きい凹凸（突起）を形成する方式は、偏光を解消しやすくして好ましくない。

【0074】前記の光拡散層における表面の微細凹凸構造は、光の拡散性やその拡散の均等性などの点より入射光の波長以上、かつ100 $\mu\text{m}$ 以下の表面粗さで周期性のない凹凸からなるものが好ましい。なお上記した透明



粒子含有型や表面微細凹凸型の光拡散層の形成に際しては、特にその樹脂からなるベース層に光弾性や配向による位相差の増加が生じることを可及的に抑制することが偏光維持性等の点より好ましい。

【0075】光拡散層は、板状物等による独立層として配置することもできるし、レンズシートに密着一体化した従属層として配置することもできる。光拡散層の配置位置が積層体に隣接することとなる場合には、上記したレンズシートに準じて積層体に対し空隙が生じるように配置されていることが好ましい。なお2層以上の光拡散層を配置する場合、その光拡散層は同じものであってもよいし、異なるものであってもよいが、その全体として偏光維持性を保持することが好ましい。

【0076】本発明による光学素子は、上記したように側面からの入射光を表裏面の一方より直線偏光として出射する特性を示すことより偏光面光源の形成に好ましく用いる。その偏光面光源は、図1に例示した如く光学素子の少なくとも一側面に光源8を配置することにより形成することができる。その光源としては光学素子、特にその積層体4の側面に配置する例えば（冷、熱）陰極管、発光ダイオード等の線状ないし面状のアレイ体、白熱球などの適宜なものを用いる。就中、発光効率や低消費電力性、細径性などの点より冷陰極管が好ましく用いる。光源は、輝度やその均一性等の点より光学素子の対向する二側面やコの字管等による三側面などの複数の側面に配置することもできる。

【0077】偏光面光源の形成に際しては必要に応じて図例の如く光源8からの発散光を光学素子の側面に導くために光源を包囲するリフレクタ81などの適宜な補助手段を配置することもできる。リフレクタには高反射率の金属薄膜を付設した樹脂シートや金属箔などが一般に用いられる。またリフレクタを図例の如く光学素子の下面に延設して鏡面反射層5を兼ねさせることもできる。さらに図例の如く光源を配置しない光学素子の1又は2以上の側面に対しリフレクタ51を配置して漏光を防止し、輝度の向上を図ることもできる。なおリフレクタは、光源の固定手段などとしても有用である。

【0078】偏光面光源の形成に際しては、適宜な光学層の1種又は2種以上を適宜な位置に配置することができる。その光学層については特に限定はなく、例えば液晶表示装置の形成に用いられる偏光板や位相差板、液晶セルなどの適宜なものを用いる。その場合、上記したレンズシートや光拡散層は、光学素子の上面に配置する光学層に接着層等を介して密着させることもできる。ただし凹凸構造を有するレンズシートや表面微細凹凸型の光拡散層の場合には、上記した空隙を設けた配置が好ましい。

【0079】なお本発明において光学素子や偏光面光源を形成する各層には、必要に応じて例えばサリチル酸エステル系化合物やベンゾフェノール系化合物、ベンソトリ

アゾール系化合物やシアノアクリレート系化合物、ニッケル錯塩系化合物等の紫外線吸収剤を配合して紫外線吸収能をもたせることができる。

【0080】本発明による光学素子や偏光面光源は、上記した如く直線偏光をその振動面（偏光軸）を制御した状態で提供することより、その特長に基づいて例えば液晶表示装置の形成など直線偏光を利用する適宜な装置や用途に用いることができる。ちなみに液晶表示装置は、光学素子を用いてなる照明装置を従来に準じて組込むことにより形成でき、例えば図1に例示の偏光面光源を照明装置とする場合にはその光出射側である光拡散層7の上側に液晶表示パネルを配置することによりバックライト型の液晶表示装置を形成することができる。

【0081】また本発明による光学素子を用いた照明装置では、外光を照明光に利用する液晶表示装置や、その外光と光源を照明光に利用する外光・照明両用型の液晶表示装置なども形成することができる。その場合、後者の外光・照明両用型の液晶表示装置を形成するための照明装置では、図3に例示した如く上記した偏光面光源に準じて光学素子、就中その透光性樹脂板1の少なくとも一側面に光源8を配置したものとされる。なお図例では光源8を包囲固定するリフレクタ81に加えて、その光源配置の側面に対向する透光性樹脂板の側面にも漏光防止用のリフレクタ52が設けられている。

【0082】前記において外光を利用するタイプの照明装置は、図3の例の如く透光性樹脂板1に対し偏光散乱板3を部分的に設けて、透光性樹脂板1に外光が効率よく入射しうる部分11を設けることにより形成することができる。その場合に液晶表示装置用の照明装置では図例の如く液晶表示装置の表示部分（液晶表示パネル）に対し120%以上、就中1.5～30倍、特に2～10倍の面積を有する透光性樹脂板1に対して、前記表示部分の90～110%、就中95～105%、特に100%の面積を有する偏光散乱板3と同面積の鏡面反射層5を部分的に設けることが外光の入射効率を高めて外光モードによる輝度向上の点より好ましい。

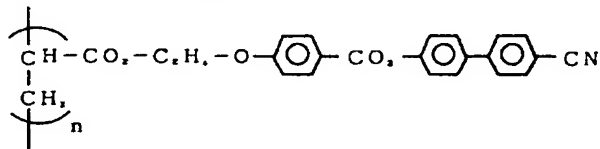
【0083】前記の照明装置を用いた外光・照明両用型の液晶表示装置の形成は、例えば図3の如く透光性樹脂板1を介し鏡面反射層5と位置対応させて配置した偏光散乱板3の上に液晶表示パネル9を配置する方式などにより行うことができる。その場合、光学素子を形成する透光性樹脂板、偏光散乱板及び鏡面反射層は、位置ズレ防止のために積層一体化した固定状態にあることが好ましい。さらに内部保護等を目的とした液晶表示装置のハウジングを設ける場合には、透光性樹脂板1の偏光散乱板を有しない部分11をハウジングの外側に突出させて、その突出部を介し外光が効率よく入射するようにすることが好ましい。

【0084】前記した外光・照明両用型の液晶表示装置では、光源を点灯した状態の照明モードによる照明光

と、表示部分の外側部分より入射した外光による照明光とによって透光性樹脂板内の発光性材料にて励起発光された光の大部分は、その樹脂板中を全反射を繰り返しながら伝送されて偏光散乱板の配置部分から直線偏光として出射するため、通常のバックライトシステムの液晶表示装置に比べより明るくて視認性に優れた表示を達成することができる。

【0085】また透光性樹脂板の側面に配置した光源による照明光を用いずに、外光等の周囲光の入射による励起発光のみを利用した外光モードだけでも液晶表示を視認することができる。その場合には上記したように発光性材料を含有する透光性樹脂板の面積が表示部分に対して大きいほど外光の入射効率が向上して、表示部分に相当する偏光散乱板より出射される直線偏光の光量が多くなり有利である。

【0086】前記において表示部分ではその部分より入射する外光が透光性樹脂板に到達するまでに、液晶層や透明電極層等を有する液晶表示パネルを透過するため光量が減少し、液晶表示パネルが偏光板等を有する場合に



【0088】前記の偏光散乱板は、ノルボルネン系樹脂からなる透明フィルム中に液晶ポリマーが延伸方向に長軸な状態でほぼ同じ形状のドメイン状に分散したものであり、屈折率差 $\Delta n_1$ が0.23で、 $\Delta n_2$ 、 $\Delta n_3$ が0.029であった。また前記の微小領域の平均径を偏光顕微鏡観察による位相差に基づく着色により測定したところ、 $\Delta n_1$ 方向の長さが約5 $\mu\text{m}$ であった。

【0089】次に蛍光染料を練込んだ厚さ2mmの市販アクリル樹脂板の片面にアクリル系粘着層を介し前記の偏光散乱板をその $\Delta n_1$ 方向が端面に対し45度の交差角となるように接着して積層体とし、その下面にPETシートに銀蒸着を施した鏡面反射シートを配置して光学素子を得、その積層体の一側面に冷陰極管を配置し、それを前記鏡面反射シートの残部をランプリフレクタとして利用して固定することにより偏光面光源を得た。

【0090】前記の偏光面光源は、光学素子における蛍光染料含有のアクリル板に基づいて冷陰極管の消灯時においても蛍光に起因する蛍光色の直線偏光が出射するのであり、冷陰極管の点灯時には通常の拡散ドットを設けただけの市販導光板等と比べ偏光板を介した観察にて輝度が飛躍的に向上したものであった。

【0091】実施例2

はその透過で光量がより減少して採光効率が低く、輝度向上に対する寄与度に乏しい。さらに発光性材料として紫外線にて励起発光するものを用いた場合には、偏光板の保護フィルム等に含まれる紫外線吸収剤によって殆どの紫外線が吸収され透光性樹脂板に到達しにくくて発光性材料が励起されにくい。そのため上記した透光性樹脂板をハウジングの外側に突出させる方式などが好ましく適用することができる。

【0087】

【実施例】実施例1

ノルボルネン系樹脂（JSR社製、アトーン、ガラス転移温度182℃）950部（重量部、以下同じ）と下式で表される液晶ポリマー（ガラス転移温度80℃、ネマチック液晶化温度100～290℃）50部を溶解させた20重量%ジクロロメタン溶液を用いてキャスト法により厚さ100 $\mu\text{m}$ のフィルムを形成し、それを180℃で3倍に延伸処理したのち急冷して偏光散乱板を得た。

蛍光染料含有のアクリル樹脂板に対してその1/3部分のみを覆うように偏光散乱板と鏡面反射シートを配置したほかは実施例1に準じて偏光面光源（照明装置）を形成し、図3の例の如くその偏光散乱板の上にそれと同面積の液晶表示パネルを配置して液晶表示装置を得た。

【0092】前記の液晶表示装置は、冷陰極管の消灯時においては偏光散乱板等を有しないアクリル板部分より入射した外光に基づいて、その外光がかなり弱い環境下においても表示内容を十分に視認することができた。また冷陰極管の点灯時には表示内容を極めて明るい状態で視認することができた。

【図面の簡単な説明】

【図1】偏光面光源例の断面図

【図2】他の光学素子例の断面図

【図3】液晶表示装置例の斜視図

【符号の説明】

4：積層体

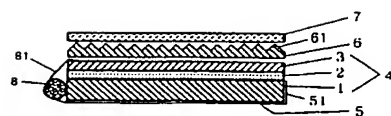
1：透光性樹脂板      2：接着層      3：偏光散乱板

5：鏡面反射層

8：光源

9：液晶表示パネル

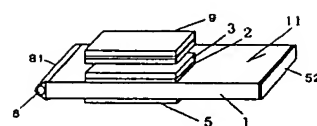
【図 1】



【図 2】



【図 3】



フロントページの続き

(51) Int. Cl. <sup>7</sup>	識別記号	F I	ターマコード' (参考)
G 0 2 F	1/1335	G.0 2 F	1/1335
	1/13357		5 2 0
			5 3 0

F ターム (参考)

2H042	BA02 BA03 BA08 BA09 BA12
	BA14 BA20 DA04 DA21 DC02
	DE04
2H049	BA02 BA42 BB42 BB52 BB63
	BB64 BC03 BC22
2H091	FA08X FA08Z FA14Z FA16Z
	FA41Z
4J002	AB02W BB03W BB12W BC03W
	BC06W BD03W BD10W BE02W
	BE06W BF02W BG02X BG06W
	BG07X BG09X BG12X BK00W
	CF00X CF06W CF08W CG00W
	CH05X CH09W CK02W CK02X
	CL00W CL00X CM04W CM04X
	CN01W CN03W CP03W CP03X
	GP00